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ABSTRACT

The Science and Mathematics Support Teacher Program (SMSTP) is a collaborative project of the College of Education at Michigan State University, the American Federation of Teachers, and the Toledo Public Schools. The goals of the program are to increase teachers' science and mathematics knowledge, improve instructional practices, and prepare teachers to conduct staff development activities in their schools with their colleagues. It requires a new staff development model containing components of three other staff development models: the developmental model, linking-agent model, and peer-coaching model. To assess the impact of SMSTP on learning and instruction over 2.5 years, observation, interview, survey, and documentation of curriculum change data were collected. Analysis of survey, interview, and documentation data suggests that the support teachers (N=8) had changed their thoughts about instruction and learning and had created their own unique roles as support teachers. The results and analysis of the data are presented and discussed. Appendixes include: "Reading List for Science and Mathematics Support Teachers"; "Teaching Style Inventory" and partial results of the inventory; "Selected Science and Mathematics Support Teacher Interviews"; "Analysis of Individual Support Teacher Interviews"; and "Changes in the Science and Mathematics Support Teacher Curriculum." (IAH)

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A NEW PROFESSIONAL ROLE FOR JUNIOR HIGH SCHOOL SCIENCE AND MATHEMATICS TEACHERS

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Too many students leave high school without the mathematical and scientific understanding that will allow them to participate fully as workers and citizens' in contemporary society. As a result, the United States risks losing its competitive edge in world and domestic markets. Several national and international reports such as the Second International Mathematics Study (McKinght, et. al., 1987) and the National Assessment of Educational Progress (Dossey, et. al., 1988) have shown the level of achievement of U.S. students in science and mathematics is below that which should be expected to meet the needs of our technological society.

In addition to low levels of mathematical and science achievement, recent reports indicate students lack sufficient understanding of necessary mathematical and scientific concepts. The results from the National Assessment of Educational Progress (NAEP) in mathematics (Dossey, et. al., 1988) showed that while most students were able to compute, the majority did not understand many basic mathematical concepts and were unable to apply these skills they learned to simple problem solving situations. The same comments apply to science as students seem to be able to memorize large amounts of information but do not know how to apply that knowledge to problem situations.

Low levels of achievement and the lack of conceptual understanding influence students' interest in, and attitude toward, science and mathematics. As a consequence, students do not enroll in advanced science and mathematics courses—thus limiting their chances for further study and better work opportunities. These problems are even more pronounced among women and minorities.

The problems of low student participation and achievement in both mathematics and science are due, in part, to the poor quality of instruction. Ensuring students the opportunity to achieve levels of excellence in science and mathematics requires significant improvement of the instruction

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which currently exists. Recent educational reports, such as those by the National Council of Teachers of Mathematics (1980, 1989), the Holmes Group (1986), and the Carnegie Task Force (1986) recognized the critical need for instructional improvement as a significant dimension of educational reform. Poor instructional quality is the result of teachers' insufficient knowledge about the content and the pedagogy of their respective subjects. Another intervening factor is teachers' lack of interaction with colleagues about content and instruction. As Chambers (1986) noted,

> Teachers tend to be isolated in their own classrooms. They have little opportunity to share information with other staff members and little access to new knowledge. Unless the proposed reforms become recognized, understood, and owned by teachers and teachers understand and are valued for their role in the reform movement, real change is unlikely to occur.

In addressing the need to improve teachers' instructional practices, Cuban (1984) suggested several strategies, including the reeducation of existing teachers through staff development efforts. He saw a two-pronged effort to staff development: First, it should improve teacher knowledge and skills; and second, it should reduce isolation and establish collegiality. If instructional excellence is to be realized, then classroom practice and the "climate" of schools must be changed.

NSF/AFT/MSU/Toledo Public School Junior High School Science and Mathematics Support Teacher Program

Research on teaching conducted over the past decade at Michigan State University's Institute for Research on Teaching demonstrates that serious, dedicated teachers want and need extended interaction with their peers and with subject matter experts, and when this is provided, practice is improved (Clark &Florio, 1983). The Support Teacher Program seeks to establish a professional development environment for extended interactions among educational personnel. Built around the concept of "teacher as instructional leader," the position of Support Teacher is a mechanism for developing local "experts" who possess the skills and knowledge around which productive interactions with colleagues can occur. It is also a vehicle for creating an environment in which teachers assist one another in self-appraisal and self-improvement to the benefit of all their

students. Through this new role, the Support Teacher and their colleagues will be better prepared to teach mathematics and science, be more highly motivated, and share a collective commitment to the teaching profession.

With its emphasis on specific subject matter content, the Support Teachers can strengthen instruction by helping teachers make important connections between teaching methods and the content of instruction—connections that have been missing in previous generic attempts to improved teaching (Cummings, 1980).

Theoretical Model

The Science and Mathematics Support Teacher Program in The Toledo Public Schools is a collaborative project of the Department of Teacher Education and the Institute for Research on Teaching (IRT) of the College of Education at Michigan State University (MSU), the American Federation of Teachers (AFT), and the Toledo Public Schools (TPS).

The goals of this program are to increase teachers' science and mathematical knowledge, improve instructional practices, and prepare teachers to conduct staff development activities in their schools with their colleagues. It requires a new staff development model containing the components of three other staff development models, these are the: Developmental Model, Linking-Agent Model, and the Peer-Coaching Model.

The Developmental Model as described in the works of Knowles (1984), Oja (1980), Glassberg & Oja (1981), Andrews, Houston,& Bryant (1981), and Tallerico (1987) includes four components necessary for this program: The first, that inservice programs contain concrete experiences followed by reflective periods for assimilation of new learnings; second, that participants need continuous support and advising; third, that participants need to be encouraged to assume more responsibilities and more complex roles in the program; and finally, that longitudinal support needs to be provided during the period when new techniques are being practiced. The Developmental Model supports and encourages the mentor teachers as they develop new curricula and implement instructional changes.

The Linking-Agent Model developed through the works of Carlson (1965), Havelock (1967), Howsam (1967), Seiber, Louis, & Metzger (1972), and Caruso (1985) uses a person designated as a change-agent whose responsibility it is to institute specific curricular practices in their schools and with their colleagues. This model is useful for the mentor teachers as they work in their schools with their colleagues.

The Peer-Coaching Model developed by Showers (1983, 1985) and Joyce & Showers (1988) is a special application of the Linking-Agent Model utilizing teachers trained in particular instructional techniques to act as coaches for their colleagues. This model is useful for two phases of the proposed program—when the Science and Mathematics Support Teacher pair work to implement instructional changes in their schools and when they support their department colleagues who will be in turn implementing curricular and instructional changes.

Features of these staff developmental models have been included in the Science and Mathematics Support Teacher Program and have as their goals the improvement of science and mathematics teaching and learning.

The program aims at implementing and studying this new professional role for science and mathematics teachers. This new role develops teachers as leaders in instructional improvement and change in the structure of schools. The innovative features of the model being piloted in Toledo include:

1) Collaboration of school personnel, union officials and university-based researchers in the development and evaluation of the model.

2) Grounding of the model upon results, conclusions and implications of extensive research on teaching including studies of actual classroom actions.

3) Establishing a new professional role in schools and preparing a cadre of junior high school science and mathematics teachers to work in their schools in that new role as exemplary practitioners and leaders in professional development activities with their colleagues.

4) Producing a framework for both introducing and implementing concepts and structures for improving classroom actions in specific subject areas.

The overarching goal of the project is to improve the opportunities of students access to understanding of science and mathematics. The means of attaining this goal are: a) implementing

instructional changes of the individual teachers; and, b) creating collegial working relationships among the school's science and mathematics faculties that support instructional improvement changes, experimentation, reflection and peer interaction in and out of the classroom.

During the fall of 1987, eight teachers were selected by their peers and administrators, one in science and one in mathematics from each of four Toledo junior high schools. From February to August 1988, these teachers were provided with over sixty hours of intensive preparation that included:

a) updating their knowledge about current research on teaching and learning science and mathematics; and

b) providing background and guided practice in working with professional peers in supportive role.

Activities of the Science and Mathematics Support Teachers

The Science and Mathematics Support Teacher Program began in the second semester of the 1987-88 academic year. Two Support Teachers (one science and one mathematics) were selected from each of four middle/junior high schools in Toledo, Ohio. The school administration of each school agreed to provide each support teacher with a half day instructional release time in order to conduct their support activities. For the remainder of the 1987-88 school year the Support Teachers attended meetings with the MSU/IRT staff and participated in reviewing, reading and discussing selected literature related to improving the curriculum, learning and instruction in science and mathematics. The teachers attended an intensive summer workshop at Michigan State University where they continued their reading and planned their support activities for the 1988-89 academic year. By the end of the workshop, each support teacher developed a support teaching plan which they would implement in the 1988-89 school year. Included in their goals and objectives were plans for their own instructional improvement as well as the improvement of the curriculum, learning and instruction of the students and teachers in their respective departments.

During the 1988-1989 school year the support teachers began working in their schools with their colleagues, the other support teachers and the MSU/IRT staff. Each of the Support Teachers found their role had evolved in ways different from every other Support Teacher. The support teachers had to be responsive to the varied needs of their teaching colleagues, the department, theadministrators and the school. After the first academic year of the program each Support Teacher had created a role unique to their own situation. There were, however, some common characteristics such as conducting regular support teacher meetings, reading, reviewing and discussing literature related to science and mathematics education, learning and instruction. Where some support teachers actively worked in classrooms with their colleagues and observing instruction and providing feedback, other support teachers did not. Added to the task of assisting colleagues was the responsibility of each support teacher to improve their own instruction. This was a difficult task and one which would take much longer than a year to accomplish. The MSU/IRT staff worked with the support teachers on a monthly basis in their schools to assist them with instructional improvements and provide support to them in their role as support teacher. Of the eight support teachers who started in the program, seven teachers remained, one mathematics support teacher discontinued participation in the program and was replaced by another mathematics teacher in the same school for the 1989-1990 academic year.

The activities of the support teachers during the 1989-1990 year continued as did the support from the MSU/IRT staff. By this time most of the teachers had established their role in the school as support teachers and had made some improvements in their instruction. The specific inschool activities of the support teachers include the following:

a) observing classes taught by other science/mathematics teachers;

b) giving constructive feedback to the teacher observed about the class/classes observed;

c) conducting meetings with the other science/mathematics teachers about instructional matters (e.g. curriculum planning, new materials, student learning, new strategies, etc.);

d) studying current literature (list of literature included in Appendix A) on the teaching and learning of science and mathematics; and

e) maintaining informal contacts with the other science/mathematics teachers and school administrators about the issues of the Support role.

Much of the work of the Support Teachers is focused on the improvement of their instruction and that of their colleagues. Furthermore, they set out to make the professional environment of schools a place where teachers work collaboratively to improve teaching and learning.

The Support teachers met one evening a month to discuss their progress and problems. They also met two days each month with the MSU-IRT program staff for technical assistance. Most of the support teachers participated in one or more meetings of local and state organizations of science/mathematics teachers to learn about recent educational developments in their content area.

Activities of the MSU-IRT Staff

The MSU/IRT staff is composed of a science educator (James Gallagher), a mathematics educator (Perry Lanier), a teacher consultant and a graduate assistant. During the 1988-1989 academic year the MSU-IRT staff provided 20 days (two consecutive days per month) of technical assistance to the Support Teachers. This technical assistance consisted mostly of working individually with each Support Teacher in his/her own school. Typically the IRT staff would spend the day in two different schools. The two other schools would be visited the following day. Each school was visited by one science and one mathematics person from the MSU-IRT staff. They would observe the Support Teacher teach his/her own classes and then give feedback about the subject matter instruction. They would also observe the Support Teacher at work with other teachers doing observations and feedback conferences or conducting departmental meetings. The visit would conclude with a thorough debriefing of these activities by the MSU-IRT staff person and the Support Teacher.

At the request of the Support Teachers there were two occasions when the technical assistance took the form of a two day seminar where the support teachers met with the MSU-IRT staff in the Toledo Public Schools Administration Building. During these seminars the teachers discussed previously distributed readings on relevant instructional strategies (e.g. group work),

educational theory issues (e.g. constructivism), etc.. A list of the readings given to the support teachers is included in Appendix A. They would also discuss problems and developments in the schools directly connected with their support role.

Data Sources and Documentation

The documentation of the impact of the Support Teacher program on the teaching and learning of science and mathematics in the four junior high schools and addresses five areas:

a) the influence of the Support Teacher preparation and role implementation on each Support Teacher's own teaching;

b) the usefulness and adequacy of the preparation program (February 1988 - August 1988) and subsequent technical assistance in preparing the Support Teachers for their new role;

c) the influence of the Support Teacher program on their colleagues in the teaching of science and mathematics at each of the four participating schools;

d) the influence of the Support Teacher program on the improvement of student understanding of science and mathematics; and

e) the influence of the Support Teacher program on the norms of Collegiality, exchange, and professional discourse of the science and mathematics departments at the four middle/junior high schools.

The question guiding the inquiry: "What is the nature and degree of change in the quality of science and mathematics instruction given this restructured staffing pattern?". The five areas described above are being studied using four data collection strategies used by the technical staff:

1) Staff members have been collecting documentation as they engaged in technical assistance. The documentation collected includes:
   a) written notes from classroom observations, meetings, feedback sessions, etc.;
   b) audiotapes of meetings and feedback sessions;
   c) teacher handouts, quizzes, tests, worksheets;
   d) samples of student work;
   e) written records of important/unusual events or conversations the staff persons witnessed;
   f) written records of Support Teacher's perceptions, recollections, comments, etc.;
   g) other documents relating to the school or the district that have something to do with the program like memos, schedules, etc..

2) Four external observers spent a total of twelve weeks in the four participating schools. The twelve weeks were distributed as three weeks per observer per school, one near the beginning of the year, another in the middle, and the third at the end. The observers followed the two Support Teachers in each school and documented the activities and events of Support Teaching. The documentation collected here includes:
   a) audiotapes of classes and meetings;
   b) photographs of the environments of Support Teaching;
   c) documents about the activities of the Support Teachers such as logs, written feedback notes, etc.;
   d) written notes of classroom observation, feedback sessions and meetings;
   e) notes about informal conversations;
   f) school documents related to the program; g) student work.

3) Interviews with the Support Teachers have been done by an interviewer, external to the MSU-IRT staff. The interviews were conducted four times during the program: March 1988, September 1988, June 1989, and May 1990. The interview protocol was designed to give information about the evolution of the thinking and beliefs of the Support Teachers as their role implementation progressed across the two years of the program.

4) Questionnaires were completed by the Support Teachers in March 1988, June 1988, September 1988, andJune of 1989. The questionnaire was designed to elicit the Support Teacher's perceptions of his/her own instructional strategies, the curriculum, and the classroom environment.

In order to manage and facilitate the exploration of this documentation an interactive data management system by computer is currently being designed by a graduate student at Michigan State University, who served as one of the external observers, and a professor in the College of Communication Arts and Sciences, at Michigan State University.

Preliminary Results and Outcomes of the Junior High School Science and Mathematics Support Teacher Program

The data is still being collected does not yet permit a thorough analysis and report of results. However, the preliminary results suggest change has taken place. The classroom instruction of the support teachers (and to a lesser degree that of their peers) is showing very encouraging changes. Teachers started listening more carefully to student answers and probing beyond the right or wrong. The phrase: "Don't give me the book definition, tell me what it means to you" is frequently heard in the four classes of the support teachers.

The questioning of the students and probing of their answers has led the teachers to a heightened awareness of students previous knowledge in science. This knowledge is made public, valued, used, and, if necessary, corrected. Answering to the question of how he knew when students did not understand, one Support Teacher said:

> Testing did not always tell you what they did or did not know. If you can sit with the kid and have him tell you what he was thinking - then you know.

Another Support Teacher says many times that she finds herself "listening more to the kids and talking less, having them play it back in their own words" to her. The support teachers had found that by sixth grade students are pretty good at "hiding behind words and memorized definitions".

Another aspect of the classroom practice that has changed in the support teachers classes is in the social organization. Teachers are incorporating more and more group activities where students have to put together different pieces of information. Previously the use of the group work (if any) was restricted to lab activities. Now groups of students are used both in the lab, in discussions, and for the interpretation of questions, situations, etc..

In order to have students construct science and mathematics in a coherent way the teachers are allowing more discussion and interaction and providing cognitive strategies that help with that construction. Most of the science teachers started using concept-mapping as a tool to help students link science concepts in creative and meaningful ways. The mathematics teachers added new units of content in the curriculum which were activity based, concept oriented and enabled students to develop new understandings of mathematical ideas. Cooperative groups, concept maps, and new units of content generated the need for teachers to develop higher level tasks. Most Support Teachers now speak with dissatisfaction for worksheets that are published -- often they describe them as being rote and boring.

The Support Teachers' preoccupation with student knowledge and understanding has generated the need for different kinds of assessment . The teachers are giving more essay questions in their tests and homework assignments in order to gain insight into the students' understanding. The science teachers are using "mind-stretchers" to start their classes. A "mind-

stretcher" is an open-ended question that links the day's lesson to the previous lesson while providing the student with an opportunity to write in his/her own words the meaning of a concept or idea.

An event in one Support Teachers' class illustrates the importance the teachers are giving to student expression of concepts and ideas in science:

> Patrick Mitchell was going to start a unit on Astronomy some weeks before Christmas. He asked the students in the first class to write what they could remember about the Universe in a piece of paper. To do this he gave them 20 minutes. Most students, according to him, wrote three to five lines, some students wrote one or two words. He then collected these papers and kept them. At the end of the unit he gave them the same piece of paper, the same task, and the same time. Most students wrote 1-2 pages, some asked for more paper and others for more time. No one wrote less than half a page. Mr. Mitchell took the papers home wrote some comments and gave them back to the students saying: "Take that to your parents and show them how much you have learned. That will be a good Christmas present".

The Support Teachers' discourse about their classes and students has also shown some interesting changes. Initially they focused on "problem students" as being a source of frustration. "Oh you have that one in your class... Well I had him last year and..." Now the focus of frustration of the Support Teachers centers on their not being able to reach these same students. They started to look at ways to engage them in the class activity. "This student here has a problem of confidence. Every time he volunteers, I go for it and give him all the encouragement." These were the teacher's own words referring in to a student in his class.

The climate in the four schools has improved from the other teachers being suspicious or skeptical to those same teachers becoming curious and hopeful. Many colleagues of the Support Teachers who questioned and resisted changing are now advocates of the program. In every one of the four schools there was a teacher who was resistant and negative and became problematic to the support teachers. There was also another teacher who was the opposite extreme, eager to try new things and who was looking forward to being helped. The others (2 or 3 teachers) fall somewhere in between.

The MSU/IRT staff and the support teachers did not expect any significant differences in student achievement within or across the four schools. The Support Teachers, however, consistently report that their students show better results on achievement tests.

Analysis of the Support Teacher Interviews, Surveys and Their Science and Mathematics Curriculum

The preliminary results of the analysis of the data adds confirmatory evidence for the possibility and benefits of extended professional roles for science and mathematics teachers. In the present reform effort, updating teachers' knowledge and skills is a crucial dimension. The findings in general include the following:

1. Each Support Teacher's thoughts and practices changed as a result of the Program. Instruction became less traditional in nature, more concept-oriented, activity based, and focused on problem-solving.

2. The activities of the Support Teacher Program adequately prepared Support Teachers for their new role by increasing their knowledge of and experience in effective instructional strategies and support techniques.

3. The teaching colleagues of the Support Teachers were influenced by the AFT/MSU/TPS Program in varying degrees. Some colleagues greatly improved their thoughts and practices while others made moderate changes. There were some colleagues at every school who resisted change altogether.

4. The results of students' achievement and attitude data is still being analyzed. However, at the end of the first year of the Program, the student results (from tests, written work, and verbal comments) indicated a more positive attitude towards mathematics and science in general, an improved ability to solve problems, and an increase in conceptual understanding.

In order to assess the impact of the Science and Mathematics Support Teacher Program on learning and instruction over the past two and a half years observation, interview, survey and documentation data were collected. Three sets of data have been analyzed at this time, these include: (1) surveys, (2) interviews, and (3) documentation of the support teachers' curriculum. The data suggests that every Support Teacher had changed their thoughts about instruction and learning and had created their own unique role as Support Teacher. The results and the analysis of the data are presented and discussed.

The Teachng Style Inventory

The purpose of the Teaching Style Inventory was to learn about the teachers thoughts regarding their instructional practices, student learning and the nature of the content of middle school science and mathematics. The science and mathematics support teachers were given similar surveys, however, minor changes were made to reflect more closely the nature of the content and methods used in the different subjects. The surveys are included in Appendix B. Examples of the survey questions for Parts I and II include the following:

PART I: CLASSROOM PROCEDURES

2.	When students have trouble, I ask them leading questions.	_____1
		_____2
		_____3
		_____4
	When students have trouble, I explain how to do it.	_____5
4.	In class, students frequently work together on assignments.	_____1
		_____2
		_____3
	Students seldom work together on assignments in class.	_____4
		_____5
7.	I present a math concept first then illustrate that concept by working several problems (deductive).	_____1
		_____2
	I present the class with a series of similar problems then together we develop concepts and methods of solving the problems (inductive).	_____3
		_____4
		_____5
11.	In my math class I emphasize the **basic computational skills** three-fourths of the time or more.	_____1
		_____2
		_____3
	In my math class I emphasize **concept development** three-fourths of the time or more.	_____4
		_____5

PART II: CLASSROOM STRATEGIES

How frequently do you use the strategy in your classses?	(A) About every day (B) Once/week or more (C) A few times/month (D) Once/month or less (E) Don't use.
21. Whole class instruction.	(A) (B) (C) (D) (E)
22. Whole class discussion.	(A) (B) (C) (D) (E)
23. Small group work other than lab work.	(A) (B) (C) (D) (E)
28. Posing open ended questions	(A) (B) (C) (D) (E)
29. Gathering and organizing students' responses.	(A) (B) (C) (D) (E)
30. Teacher demonstrations.	(A) (B) (C) (D) (E)
31. Analysis of data from labs or demonstrations.	(A) (B) (C) (D) (E)

The Teaching Style Inventory was administered to the Support Teachers four times during the first year and a half: (1) at the start of the program (February 1988); (2) after 4 months of teacher participation in program activities (June 1988) ; (3) following an intensive summer workshop (September 1988); and, (4) at the end of the first school year of the program (June 1989). Analysis of the survey data suggest the following:

1. The teachers had changed their thoughts about teaching middle school science and mathematics. They moved from a more procedural/traditional view of teaching and learning to a more conceptual/nontraditional view.

2. During the teachers' involvement in the program their thoughts changed at different rates. That is, some teachers changed their thinking about teaching and learning before others. The greatest range of scores in the surveys of the mathematics teachers occurred during the second survey. The greatest range of the scores of the science teachers occurred during the second and third survey.

3. By the fourth survey the responses of all the teachers were in close agreement. They were thinking more alike and they were thinking in more conceptual/nontraditional ways.

Analysis of the Teaching Style Inventory

The Teaching Style Inventory consists of 4 sections of which two were used in this analysis: Part I (Classroom Procedures) and Part II (Teaching Strategies). The method of analysis captured the changes in the teachers thinking about instructional practices. This method involved comparing the teacher's "actual" response with an "ideal" response for each item. The "ideal" response characterized the practices which reflect conceptual/nontraditional instruction. If a teacher's "actual" response was **2** and the "ideal" response was **5**, the difference of **3** was recorded. This value of **3** represented the difference (or distance) between the "actual" response and the "ideal". A sum of these differences for all the items was calculated for every survey. The difference between the sum on the first and last survey represented the amount of change that occured. **The lower this number the closer the teacher's "actual" responses were to the "ideal"**. There were a more items on the science Teachers Style Inventory than were on the Teaching Style Inventory for the mathematics teachers. A total score of **0-28** on the math inventory or **0-43** on the science inventory indicates responses that were close to an "ideal" response difference of 0 or 1 for each item. This score suggests a conceptual/nontraditional instructional approach. A total score of **84-112** on the mathematics inventory or **129-172** on the science inventory indicates responses in items were far different from the "ideal" response, suggesting a procedural/traditional approach. The results for Parts 1 and 2 are included in Appendix B. The results for Parts I and II collectively are presented in the following table and graph.

Results of the Teaching Style Inventory

Parts I and II

Teaching Style Inventory: Mathematics Teachers

(Ideal = 0-28)

Teacher	March 88	June 88	September 88	June 89	Change (3/88 to 6/89)
WB	47	42	31	25	-22
SD	43	36	35	31	-12
VM	58	59	37	38	-20

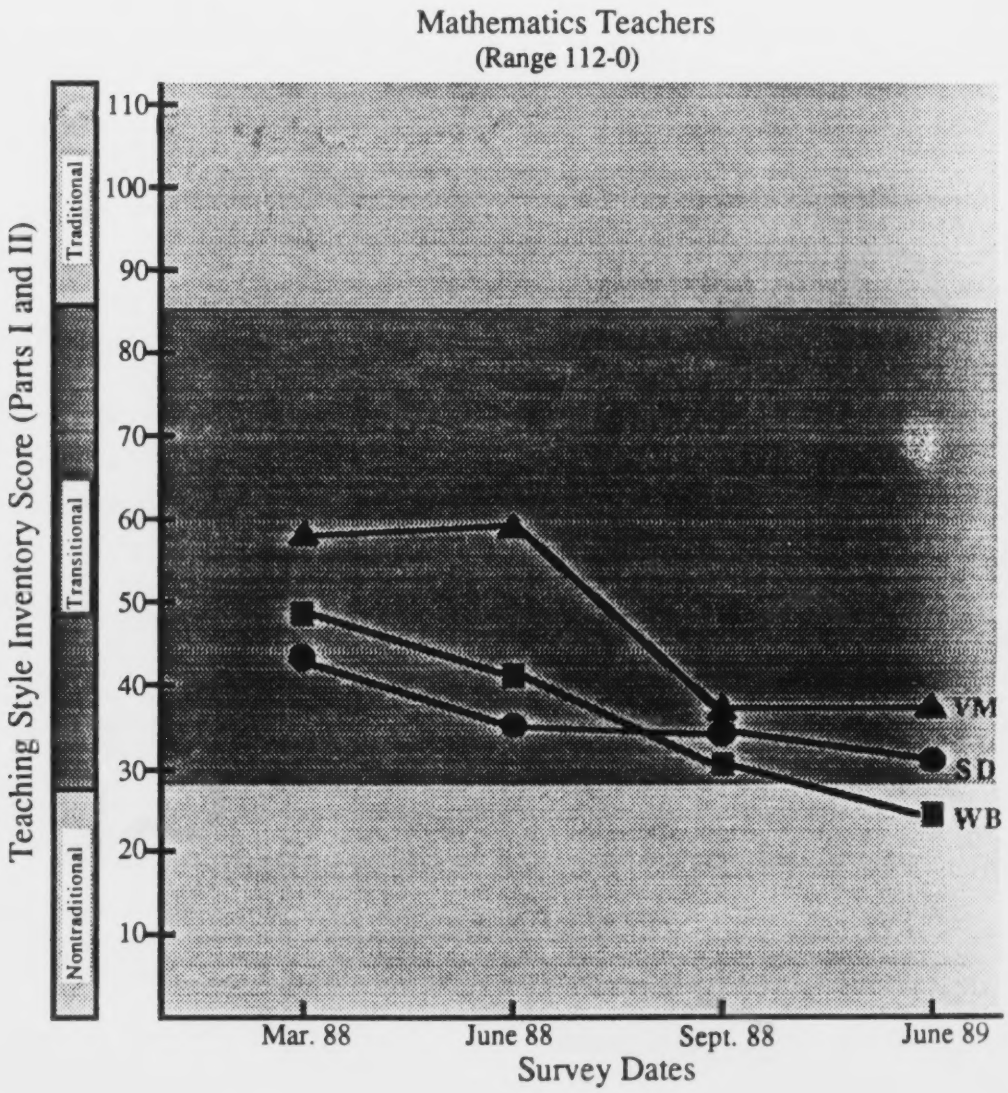
Parts I and II

Teaching Style Inventory: Science Teachers

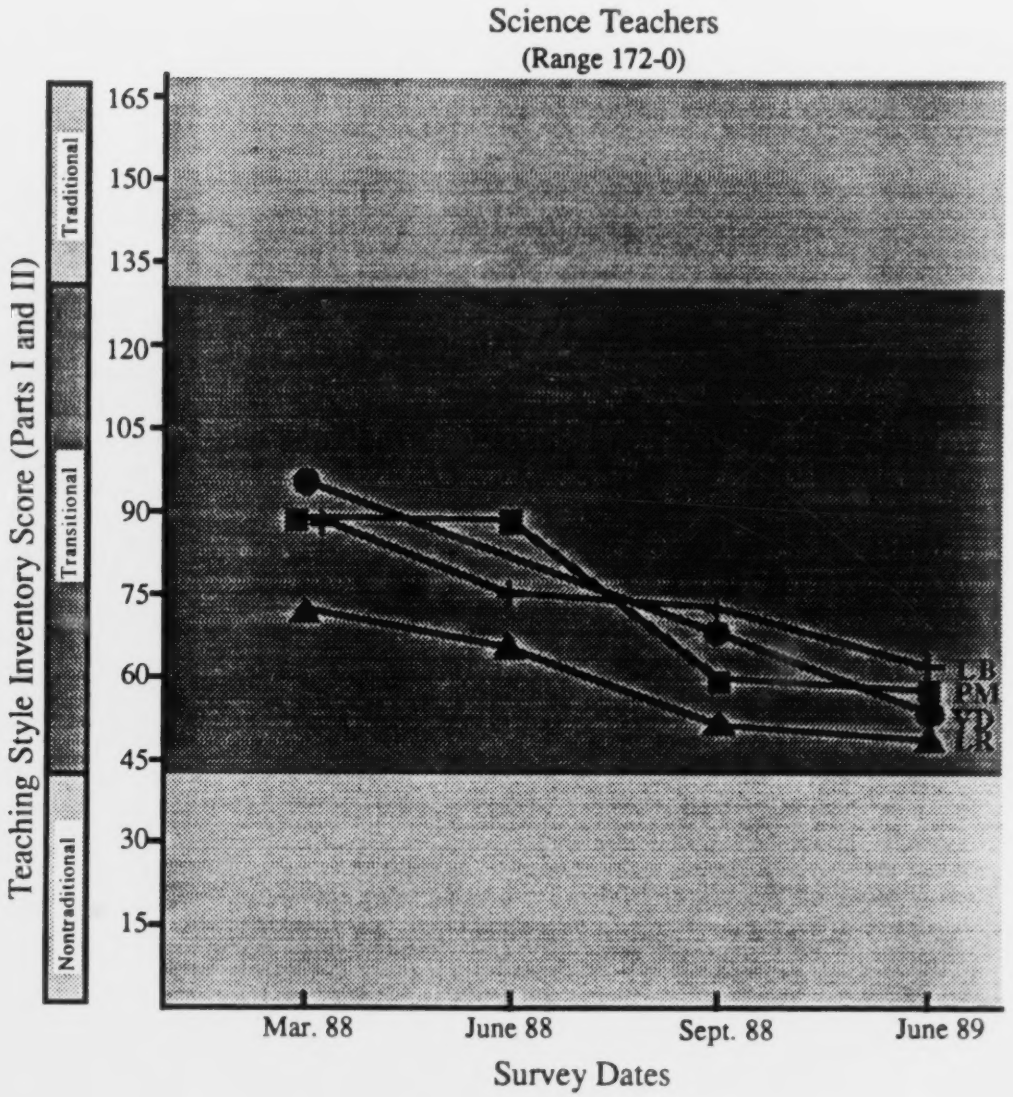
(Ideal = 0-43)

Teacher	March 88	June 88	September 88	June 89	Change (3/88 to 6/89)
LR	73	63	51	50	-23
PM	89	89	59	54	-35
VD	94		69	55	-39
LB	89	75	71	62	-27

Results of the Teaching Style Inventory



Results of the Teaching Style Inventory



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Discussion of the Results on the Teaching Style Inventory

The results of the Teaching Style Inventory indicate that the science and mathematics support teachers had changed their thinking about instruction and learning. They had changed from a more procedural/traditional to a more conceptual/nontraditional approach over the year and a half. Their responses to the items on Parts I and II of the survey had moved closer to the "ideal" responses. The change in their thinking took place gradually and probably resulted from their participation in the programs' activities. It should be noted that the observational data of their actual classroom instruction lagged behind their survey responses. That is, although the teachers had changed their thinking they were not yet able to implement fully a conceptual/nontraditional instructional approach in their classes. This was a point of frustration for each Support Teacher -- knowing what they wanted to change in their instruction and not being able to accomplish it as fast and with as much success as they would have liked.

The Support Teacher Interviews

The interview questions captured the changes in the Support Teachers' thinking of the about topics not covered in the Teaching Style Inventory. The results of the interviews over the two and a half years suggests the following:

1. Both the science and mathematics support teachers had changed their thoughts about teaching and learning and their role as support teachers.
2. Six of the seven support teachers had moved from a traditional to a nontraditional orientation by the last interview. However, none of the support teachers had reached the nontraditional orientation until the end of the second year.
3. The greatest range in the interview responses seemed to be with the science support teachers.

The Support Teacher Interviews

The Support Teachers were interviewed four times during the program: (1) March 1988; (2) September 1988; (3) June 1989; and (4) May 1990. Each interview lasted from one to one and a half hours. Four sets of interviews were analyzed. The Support Teachers were asked open-ended

questions relating to their teaching, student learning and the support teacher program. The following are the questions selected for analysis:

SUPPORT TEACHER INTERVIEW QUESTIONS

1. What are the big ideas in _____grade _____mathematics_____science?

2. (a) How do you know when a class period is/is not going well?
   (b) Describe a class period that you thought went well recently.

4. (a) What motivates your students to learn the content?
   (b) What motivates your students to complete their assignments?

6. How important is practice in your classes?

7. One frequently hears the statement, *"It is important that students understand the content."*
   (a) What does that mean to you?
   (b) How do you know when students do not understand the content?

9. What characteristics do you like to see in your students?
   What characteristics do you like to see in your classes?

10. How would you describe your role as teacher?

11. What is your interpretation of the Support Teacher role?

12. What would improve the learning opportunities for your students?

13. What improvements would you suggest on a school-wide basis?

14. How do you assess the Support Teacher Program activities so far?

Analysis of the Support Teacher Interviews

An instrument was developed to measure, the degree to which teachers' thoughts and practices reflect traditional/procedural or nontraditional/conceptual instruction. Three major categories (content, communication patterns, and the learning environment) were identified and used in the analysis. These categories emerged from a synthesis of the research on learning and instruction as areas of instruction which could be identified as procedural/traditional or conceptual/nontraditional. A fourth category, the Support Teacher Role, was included in order to capture the thoughts of the teachers about their new role as it evolved.

The categories were used to examine the interview and observational data. A level 3 represents a procedural/traditional instructional approach, a level 1 characterizes the conceptual/nontraditional instructional approach and a level 2 indicates instructional thoughts or practices which are improved from level 3, but not yet optimal (as in level 1). These levels provided a method to compare the teachers' interview responses as well as their instructional practices. The following is a summary of the 3 levels of each of the 4 categories. The categories will be discussed and examples from the Support Teacher interviews will be used to illustrate the changes in their thinking.

The Content of the Science or Mathematics Curriculum. This category includes the nature of the content, the tasks selected, topics covered, and how learning is evaluated. The following describes three levels in this category. This is followed by segments from the interviews which exemplifies the changing thoughts of a Support Teacher about the content.

CONTENT:

LEVEL 3: Procedural/Traditional	LEVEL 2: Transitional	LEVEL 1: Conceptual/Nontraditional
Procedural/computational orientation.	Concept orientation with no linkages to other content or topics.	Concept orientation with linkages to other content or topics.
Topic centered curriculum.	Familiar topics/units set in a new context.	Topics/units focus on unifying concepts.
Routine tasks to develop skills.	Tasks are interesting although routine and focus on the concept studied.	Tasks are interesting/challenging and engage students in active learning experiences that enhance conceptual understandings.
Evaluation consists of paper & pencil tests to measure procedural knowledge.	Evaluation consists of paper & pencil tests which measure procedural and concept understandings.	Evaluation includes paper & pencil tests, interviews, and observations focused on students' conceptual understanding.

CONTENT: Wilma Burns (Mathematics Support Teacher)

"What are the big ideas in 7/8 grade mathematics/science?"

March 1988

It is the last time they will have to learn mathematics. It is covering the basics--add, subtract, multiply, divide and problem solving. That is why I let them use calculators.

September 1988

Numeration. I need to go back to what was on the blackboard [from the summer workshop] Geometry, Factoring, Estimating, Rational Numbers. My thinking has changed. It's now organizing my thoughts to the big ideas. I am not so fragmented in my thinking about where this content is going to fit into the big picture. I can justify not teaching something in one place and covering it in another. So I don't have to spend so much time going page by page.

June 1989

Factors, multiples, ratio, measurement, similarity, patterns, numeration, problem-solving.

May 1990

Number theory, rational numbers, decimals, percents and linking them together. Probability and statistics, problem solving that is integrated into the curriculum, and geometry. My changes in thinking over the years has been in establishing linkages and requiring less memorization.

In the first interview about the content of the mathematics curriculum, Wilma Burns describes a curriculum that represents a procedural/traditional approach. By the fourth interview her thinking had changed to where she now sees the content of the mathematics curriculum differently. Her focus is now on mathematical concepts and the connections between units of content. This change was also observed in her classroom instruction.

The Patterns of Communication. The next category considers the patterns of communicatin in the classroom. Contained in this category are the teacher's questions, explanations, discussions, feedback/expectations and the degree to which students participate in communicating in the classroom. This is followed by the responses of two teachers to an interview question which relates to communication and student understanding.

COMMUNICATION:

LEVEL 3: Procedural/Traditional	LEVEL 2: Transitional	LEVEL 1: Conceptual/Nontraditional
Instruction is demonstration without student participation.	Instruction is mostly demonstration with limited student participation.	Instruction is guided-discovery with active student participation.
Teacher's questions require one-word responses from students.	Teachers questions require students to give some explanation.	Teacher's questions are open-ended and require students to provide an explanation. Controlled-practice is used to promote student understanding.
Teacher's explanations focus on procedures or definitions.	Teacher's explanations focus on some concepts or procedures.	Explanations embellish and enrich the concept/idea being studied.
Discussions are limited to the development of a skill, definition or procedure.	Discussions are focused on concepts, but students don't initiate the ideas.	Discussions are interesting, meaningful and students actively initiate thoughts, conjectures and ideas.
Feedback is used to keep students on task.	Feedback is concept-related, but not focused on student understanding.	Feedback is specific and related to the students' understanding of the concept or idea.
Low teacher expectations for student success in learning the content. The teacher does not take responsibility for student failure.	Moderate expectations for student success in learning the content. Student failure may be attributed to their not understanding the concepts.	High teacher expectations and responsibility for student success in learning the content and concepts.

COMMUNICATION: Susan Day (Mathematics Support Teacher)

"One frequently hears the statement, 'It is important that students understand the content.'
(a) What does that mean to you?
(b) How do you know when students do not understand the content?"

March 1988

(a) It means more than the ability to do an operation. It should mean seeing a lot more about a particular problem. It's more than what's in the book. (b) By their responses--the students will verbalize to me that they don't understand. Sometimes I give them a couple of problems and I can get around the class to see if they have problems.

September 1988

(a) Understanding the content to me has changed. Because not it is becoming more crucial that they not just are able to give me an answer, but that they actually understand what they've done. To me, now, that means understanding the content. Asking students, "What did you do?" and "Explain it to me." (b) By asking them to explain it to me. When they can give me another example or they can verbalize to me what they have done. An A on a test doesn't tell me they really understand it.

June 1989

(a) The student has an understanding of the concept it doesn't mean that he/she just memorizes a rule. It is important that they understand what they are attempting to do and not just applying a formula. (b) If they can apply an idea in a problem solving situation--if they can represent the idea by drawing it and writing about it is further evidence that they understand. Writing in mathematics came from a reading in the School Science and Mathematics Journal I read in March. Drawing whatever they might be working on is a way for them to see what they understand. Using some of their problem solving strategies helps them understand. Next year I have been taking a look at ways to evaluate

May 1990

It has come to mean that the students can use and apply what they have learned to various situations. That they have various ways to see and solve problems. It means that they don't just have one way to see things. Understanding is not just remembering memorized rules. The students need to know why they are doing what they are doing.

COMMUNICATION: Larry Brown (Science Support Teacher)

"One frequently hears the statement, 'It is important that students understand the content.'

(a) What does that mean to you?

(b) How do you know when students do not understand the content?"

March 1988

(a) If you are teaching from the book the students should know what we cover in class. You have a hard time teaching concepts without the content. (b) Class discussions, tests, quizzes. Mainly it is class discussions.

September 1988

(a) That has changed. Content was always terminology and I am finding another way of approaching concepts. Content now means understanding the concepts. Mind stretchers have helped. (b) Testing didn't always tell you what they did or did not know. If you can sit down with the kid and have him tell you what he was thinking--then you know.

June 1989

Content used to be the terminology--Now it is trying to get an understanding of the ideas and learning them. It is not just a bunch of words. I have changed my use of the textbook. There is just too much there in the textbook.

May 1990

> That they know the content--traditionally, it has been memorizing the terms. There is a lot less content--it is still there, but there is no way it can all be covered. They understand it when they've thought through what we've been discussing and they really understand the big ideas. "Why?" is the big question.

This interview question was included to capture the teachers' thoughts about student learning and understanding. However, in the teachers' responses were references to the importance of communicating with students in order to learn about their understanding. In the examples above, both Susan Day and Larry Brown had changed their thoughts about student learning and the importance of communication. They previously measured understanding by how well the students could compute answers to problems or by results on a test or quiz. Now, understanding is assessed through discussions and dialogues of the concepts/ideas or by the student's application of the concepts to new situations. Teaching for understanding, whether in science or mathematics, requires a classroom environment where students have many opportunities to discuss and communicate their thoughts about the concepts being studied.

The Social Organization and the Learning Environment. This category considers how teachers organize students for learning the content, what they use to encourage/promote learning, how they organize the curriculum for learning the content and how instructional/class time is spent by the students. The interviews of one teacher note the changes in the characteristics she likes to see in her students and classes.

LEARNING ENVIRONMENT:

LEVEL 3: Procedural/Traditional	LEVEL 2: Transitional	LEVEL 1: Conceptual/Nontraditional
Students are expected to work individually on their tasks.	Students work occasionally in groups, but tasks are not developed purposefully for the groups.	Cooperative groupings are used and the activities promote the development of concept understanding.
Manipulatives and illustrations are not used or are used in ways that promote student understanding of the content.	Concrete manipualtives and illustrations are demonstrated by the teacher to help students better understand the concepts.	Concrete manipulatives, illustrations and activity-based experiences are used to help students understand the concepts being studied.
The curriculum is textbook bound and fragmented into unrelated units and topics.	The curriculum is changing to reflect concepts and ideas. The teacher is relying less on the textbook for curriculum planning.	The curriculum integrates concepts and ideas through strands which connect and unify units of content.
Students spend time socializing before and after the lesson.	The teacher inconsistently plans for students to work on a task before or after the lesson.	Students are engaged in content related activities before and after the lesson.

LEARNING ENVIRONMENT: Wilma Burns (Mathematics Support Teacher)

"What characteristics do you like to see in your students, and classes?"

March 1988
Students and classes that try hard and that work together.

September 1988
I like to see them come in and sit down and be ready to get busy with what we are going to do.

June 1989
Questioning, kids that accept and work well with other kids. Willingness to try. Not afraid to talk or to try.

May 1990
Kids actively involved in what's going on. Kids talking with one another. Students taking on a helping attitude in math. Kids helping one another. To have fun in math. That they are there to help everybody.

In the first interview, effort and hard work were important characteristics of students and classes for Wilma Burns. She had changed her thinking by the fourth interview to focus on the

students becoming actively involved and helping one another in cooperative settings. By the last interview most support teachers were using cooperative groups in their classes and many were requiring students to work on some kind of content-related activity at the beginning of class. Observations indicate that students were spending more time on content-related activities by the end of the program than they were at its start.

The Support Teacher Role. The role of the support teacher evolved over the two and a half years of the program. At first the support teachers had no idea what they would be doing as a support teacher. By the end of the program most support teachers had constructed their own view of the role of a support teacher.

SUPPORT TEACHER ROLE:

LEVEL 3: Procedural/Traditional	LEVEL 2: Transitional	LEVEL 1: Conceptual/Nontraditional
The teacher either has no idea of the role or sees the job of the support teacher as a resource person who provides materials to the teachers.	The Support Teacher's idea of the role is changing. There is an awareness that it involves more than being a resource person. The support teacher is conducts teacher meetings and assists teachers as needed.	The teacher sees the role as one of working with teachers in a variety of ways. The Support Teacher has improved their instruction and is committed to improve learning and instruciton of their department. The activities of the Support Teacher include conducting meetings, colleague observation and feedback, reading literature and curriculum improvement.

SUPPORT TEACHER ROLE: Patrick Mitchell (Science Support Teacher)

"What is your interpretation of the support teacher role?"

March 1988

Nobody knows. I need some direction about what's going on. I don't know what's happening. I have to make a classroom observation of what's going on in the classroom--it is very vague. Half the people at our meeting couldn't figure out the readings. Are we supposed to come up with better teaching methods? Is that what we are supposed to be doing? Are we trying to find out what works?

September 1988

> Being able to come up with better teaching methods, help other people who want help in finding better ways of teaching and learning more by observing teaching. I am becoming much keener in what I am looking for when I observe. I am a resource person. I am careful in what I say and do with the teachers.

June 1989

> A lot of things. The first is to get the faculty more involved as a unit--to exchange ideas. The second, as a resource person for new people. To set up resource labs and to set up meetings where we can exchange ideas. To get them involved as much as I can. To try to get teachers to understand I am not a dictator, that we are here to improve our teaching and most of all to improve our kids results. I start the year with short 15 minute meetings and the time eventually increases over the year. We go anywhere from 20 minutes to an hour. By the end of the year the teachers carried the ball for the meetings.

May 1990

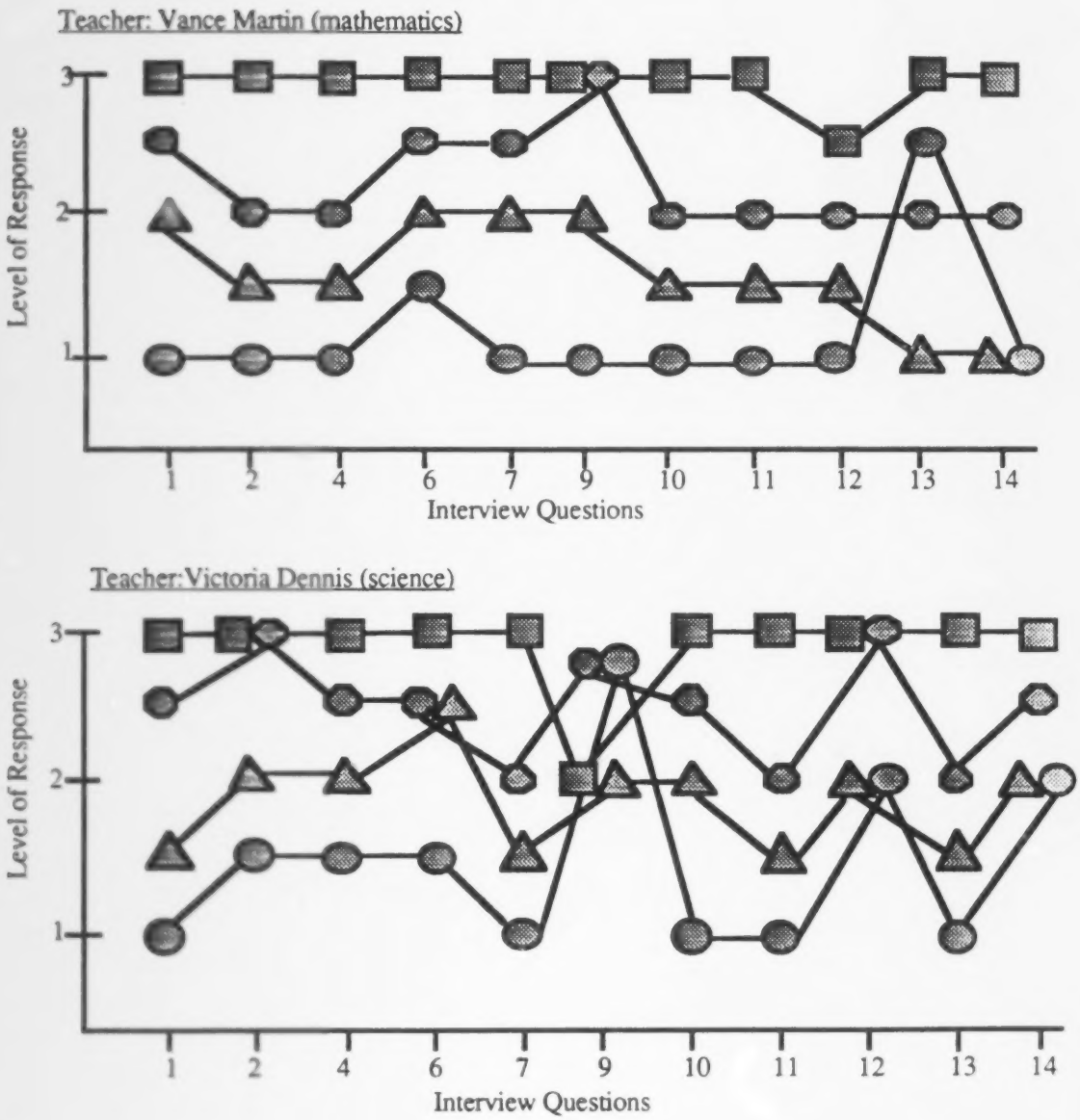
> Many factors. I am a counselor, a whipping board, a resource person, an experimenter, working with people, a public relations person, and an observer. I help teachers improve their teaching. I'm a facilitator at meetings. I have to be flexible and fluid. There are many facets to the job. There is the liaison between me and the administration. A liaison between me and the teachers. Stroking teachers and saying something positive. I have to practice what I am preaching and I have to work at changing my teaching. I see myself as a researcher. I am a doctor, constantly practicing and changing my ways of teaching and trying to convince others to see the value of group work. My role changes based on the problems you run into. A military guideline won't work, it's got to be fluid.

Patrick Mitchell moved from having no idea of the role of a Support Teacher to his rather detailed construction of this role. Patrick's responses across the four interviews shows how his ideas about the role had evolved. It should be noted that none of the Support Teachers saw their role in exactly the same way. Their roles were the result of their unique school and department situations and the teachers with whom they worked.

Results of the Analysis of the Support Teacher Interviews

The interviews of each teacher were analyzed by using the categories described above. Each teacher's responses to the questions were given a level (1, 2, 3) and were compared across the four interviews. A charting of the levels of responses was done for each of the seven support teachers. These are included in Appendix C. The analysis of interview responses for one mathematics and one science support teacher is included in the charts below.

Levels of Support Teacher Responses to Interview Questions



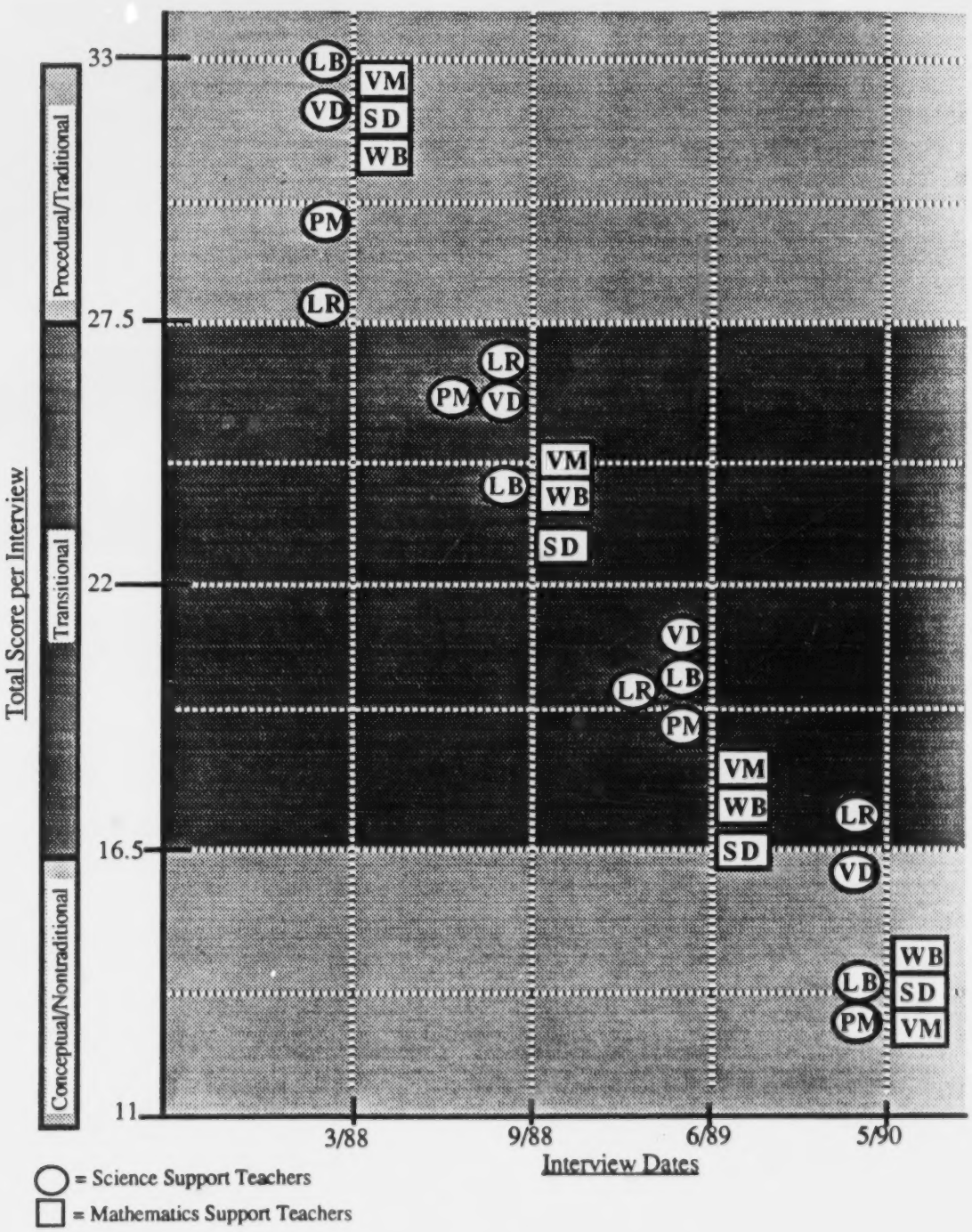
In order to compare the teachers' responses across the four interviews a total score was obtained for each interview. This total score was the result of the sum the levels of the responses for each interview. A level of 1 represents a conceptual/nontraditional orientation, so the total score for the responses of the interviews over time should be moving closer to the "ideal" total score of 11. The following table and graph represents the total scores for the support teachers across the four interviews.

Levels of Responses of the Support Teacher Interviews

Support Teacher Interview Results				
	March 1988	Sept. 1988	June 1989	May 1990
WB	31	24	17.5	14
SD	31.5	23	16.5	13
VM	32.5	24.5	18	13
LB	33	24	20	13.5
VD	32	26	20.5	16
PM	29.5	26	19	13
LR	28	26	19.5	17.5

Scores	Level Description
11-16.5	Conceptual/Nontraditional
17-27.5	Transitional: Procedural/Conceptual, Traditional/Nontraditional
28-33	Procedural/Traditional

Levels of Responses of the Support Teacher Interviews



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Discussion of the Support Teacher Interview Results

The results of the interviews indicates that the support teachers had changed their thinking regarding the content, communication, the classroom environment, and their role as a support teacher. These results support the findings of the Teaching Style Inventory. By June 1989, the interview and survey results show the teachers were in a transitional stage of their thinking. The interviews of May 1990 show the teachers had moved to a conceptual/nontraditional view of teaching and learning. Interestingly, the range of scores of the science support teachers on the first and last interview was greater than the range of scores of the mathematics teachers. Of particular importance is the finding that change in teachers' thinking about learning and instruction is gradual and evolves over time. While their thinking had changed over the two and a half years, their practice had not yet reached the conceptual/nontraditional level. None of the teachers felt they were completely successful in implementing all the changes they had planned. Changing teacher practice will likely take longer.

Changes in the Support Teachers' Science and Mathematics Curriculum

In order to determine if changes were taking place in the classrooms of the support teachers, they were asked to describe their science or mathematics curriculum before their work in the program and their curriculum for the 1990-1991 academic year. The results indicate that the content the teachers were teaching had changed and their approach to the subject matter was more unified. The following are descriptions of one mathematics and one science teacher's curriculum. The curriculum descriptions of all the support teachers is included in Appendix D.

Vance Martin-Mathematics Curriculum

1986-1987	
TOPIC	WEEKS
Whole Numbers & Operations	3 1/2
Integers	3
Exponents & Powers of Ten	4
Decimals	3 1/2
Percents	4
Fractions	6
Equations	3
Coordinate Graphing	4
Geometry	4
Metric Measures	3

1990-1991	
TOPIC	WEEKS
Integers	2
*Mouse & Elephant Unit	7
*Factors & Multiples Unit	7
Fractions, Decimals, and Percents	5
Equations & Graphing	4
Probability & Statistics	4
Problem Solving Strategies	9

*Middle Grades Mathematics Project Unit, Addison-Wesley Publications

Victoria Dennis-Science Curriculum

1986-1987	
TOPIC	WEEKS
Introduction to Science (and Metrics)	6
Weather	8
Astronomy	7
Fresh Water & Oceans	3
Rocks & Minerals	2
Earthquakes, Volcanoes	
Plate Tectonics	3
Weathering & Erosion	4
Glaciers	3

1990-1991	
TOPIC	WEEKS
Introduction to Science (and Metrics)	7
Weather	12
Astronomy	8
Fresh Water & Oceans	4
Rocks & Minerals	3
Earthquakes, Volcanoes	
Plate Tectonics	4

Both Vance Martin and Victoria Dennis had changed their curricula from 1986-87 to 1990-91. The same is true for the other Support Teachers in the program. Eventhough they taught different subjects there are some similarities in their curricular changes. First, they are now spending more time studying larger units of content. Second, their 1990-91 curriculum is less fragmented than their 1987-88 curriculum. The teachers all report trying to build a science and mathematics curriculum that focuses on big ideas or concepts and the connections between them.

Comments on the Junior High School Science and Mathematics Support Teacher Program

The Science and Mathematics Support Teacher Program provided the opportunity for teachers to improve the quality of their classroom instruction and to work with their teaching colleagues to improve learning and instruction at a department level within their schools. Evidence from interviews, surveys and documents indicates that the changes which took place in the thoughts and practices of the support teachers took place gradually and evolved over time. Even at this stage, after two and a half years, the support teachers are still working to change their classroom practice. Some teachers are just beginning to implement successfully cooperative learning techniques, others are working to build a cohesive and concept oriented curriculum, and others are focusing their attention on strengthening the commmunicartion patterns in their classes. All the support teachers are continuing their work with their colleagues at the department level to restructure their programs.

Indeed, Support Teachers have reported that their students have responded positively to new techniques and instructional ideas they have implemented. Moreover, teachers have demonstrated increased confidence and competence which has resulted from dialogues with their peers and from engaging collaboratively in significant professional growth activities. Teachers and students alike have benefited from the establishment of a new professional role that keeps exemplary teachers in the classroom and also extends their influence to other teachers through the establishment of the new role of Support Teacher.

MSU/Toledo Public Schools
Mathematics & Science Support Teacher Project

Appendix A

Reading List for

Science and Mathematics

Support Teachers

SUPPORT TEACHER READINGS

Support Teacher Role

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Glickman, C.D. (1985). Observing skills. In C.D. Glickman, Supervision of Instruction (pp. 207-231). Boston: Allyn and Bacon, Inc.

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Johnson, D.W. & Johnson, R.T. (1987). Research shows the benefits of adult cooperation. Educational Leadership, 45, 3: 27-35.

Meyers, Y. (1981). Mental health consultation. In J.C. Conoley (Ed.) Consultation in schools: Theory, Research, Procedures (pp. 35-53). New York: Academic Press, Inc.

Neubert, G.A. & Bralton, E.C. (1987). Team coaching: staff development side by side. Educational Leadership, 44, 5: 29-32.

Servatius Y.D., & Young S.E. (1985). Implementing the coaching of teaching. Educational Leadership, 42, 7: 50-53.

Showers, B. (1985). Teachers coaching teachers. Educational Leadership, 42, 7:44-48.

Science Teaching

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Arnaudin, M.W. & Mintzes, J.J. (1985). Students' alternative conceptions of the human circulatory system: A cross-age study. Science Education, 69, 5: 721-723.

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Erickson, G. & Tiberghien, A. (1985). Heat and temperature. In R. Driver, E. Guesne & A. Tiberghien (Eds.), Children's ideas in science (pp. 52-84). Philadelphia: The Open University Press.

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Klein, C.A. (1982). Children's concept of the earth and the sun: A cross cultural study. Science Education, 65, 1: 95-107.

Lawrenz, F. (1986). Misconceptions of physical science concepts among elementary school teachers. School Science and Mathematics, 86, 8: 654-660.

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Harvard Graduate School of Education (1987). Teaching for understanding in the age of technology (Position paper). Cambridge, MA: Author.

Johnson, D.W. & Johnson R.T. (1975). Structuring cooperative learning. Learning together and alone: Cooperative, competitive and individualistic learning (pp. 43-63). Englewood Cliffs, NJ: Prentice Hall, Inc.

Johnson, D.E. & Johnson, R.T. (1975). Student acquisition of collaborative skills. Learning together and alone: Cooperative, competitive and individualistic learning (pp. 105-123). Englewood Cliffs, NJ: Prentice Hall, Inc.

MSU/Toledo Public Schools
Mathematics & Science Support Teacher Project

Appendix B

B-1 Teaching Style Inventory

B-2 Results of Part I and Part II

Science and Mathematics Support Teachers

Appendix B-1

Mathematics Teaching Style Inventory

PART I CLASSROOM PROCEDURES

Check the point within each of the following scales which most accurately describes your math class. (If you are teaching math for the first time or your present situation is very different from previous years, please respond as you anticipate your class will be like this year.) Respond according to what actually happens, not what you think should happen, or what you would like to have happen. There are no right or wrong answers.

Answer all the questions.

1. Almost all help is initiated by students asking for it. _____1 _____2 _____3 _____4 Almost all help is initiated by my seeing the need for it. _____5

2. When students have trouble, I ask them leading questions. _____1 _____2 _____3 _____4 When students have trouble, I explain how to do it. _____5

3. Almost always many different activities are going on simultaneously during math class. _____1 _____2 _____3 Almost all the time the students are all engaged in the same activity during math class. _____4 _____5

4. In class, students frequently work together on assignments. _____1 _____2 _____3 _____4 Students seldom work together on assignments in class. _____5

5. When studying a math unit, students spend some time working in small groups to solve a big problem. _____1 _____2 _____3 When studying a math unit, students will not be working in small groups to solve a big problem. _____4 _____5

6. I encourage students to solve a given math problem the way I have demonstrated. _____1 _____2 _____3

I encourage students to solve math problems in a variety of ways. _____4 _____5

7. I present a math concept first then illustrate that concept by working several problems (deductive). _____1 _____2

I present the class with a series of similar problems then together we develop concepts and methods of solving the problems (inductive). _____3 _____4 _____5

8. Certain topics are repeated (but in more depth) on a regular basis throughout the year. _____1 _____2 _____3

Once a topic is covered that same topic is not covered again except during reviews. _____4 _____5

9. When I teach a new topic, I spend a good deal of time (1/3) trying to teach students to see similarities and differences between new and previously learned math ideas. _____1 _____2 _____3

New topics are generally taught with limited reference to previously learned math ideas. _____4 _____5

10. The furniture arrangement is the same for every math lesson. _____1 _____2 _____3 _____4

The furniture arrangement varies according to the lesson. _____5

11. In my math class I emphasize the basic computational skills three/fourths of the time or more. _____1 _____2 _____3

In my math class I emphasize concept development three/fourths of the time or more. _____4 _____5

12. I seldom change my approach throughout the semester (such as lecture-discussion, discovery, etc.) _____1 _____2 _____3

I change my approach frequently (from discovery to direct telling or from another method to something different) throughout the semester. _____4 _____5

13. Understanding why a given rule or procedure gives the correct answer is important. _____1
_____2
_____3
_____4
Understanding the rule or procedure is not critical. _____5

14. Almost all my questions in math class can be answered with yes, no, or a number. _____1
_____2
_____3
Almost all my questions in math class require the students give explanations. _____4
_____5

15. In my class, I give different assignments to students with different ability levels. _____1
_____2
_____3
_____4
In my class, I give the same assignments to all students. _____5

16. I usually use a game, story, or challenging problem to provide a context for a new math unit. _____1
_____2
_____3
I usually do not use a game, story, or challenging problem to provide a context for a new math unit. _____4
_____5

17. I usually start a new math unit by giving examples and showing students how to work them. _____1
_____2
_____3
I do not usually start a new math unit by giving examples and showing students how to work them. _____4
_____5

PART II STRATEGIES

How frequently do you use the strategy in your classses?

	Very Frequently	Frequently	Sometimes	Seldom	Never
18. Whole class instruction					
19. Whole class discussion					
20. Posing open-ended challenges					
21. Gathering and organizing student responses					
22. Encouraging analysis and generalization					
23. Assigning homework					
24. Discussing homework					
25. Using concrete manipulatives					
26. Using games					
27.. Drills					
28. Story problems					
29. Non-routine problems					

PART III TEACHER OPINION

Select the appropriate choice for each statement

A = Agree
B = Somewhat agree
C = Undecided
D = Somewhat disagree
E = Disagree

30. _____ I am an effective mathematics teacher.

31. _____ I like doing mathematics.

32. _____ My basic function as a math teacher is to convey my knowledge of math to the students in a direct manner.

PART IV COMPLETION

33. As of today, I have _____ students that are discipline problems.

34. I assign math work to be done at home about _____ times a week.

35. Think of your average student. When you make a homework assignment, approximately what percentage of the time is it:
_____ completed in class by most students
_____ begun in class but finished at home.
_____ done entirely (100%) at home.

36. When some students do poorly on tests or indicate that they have not understood a topic in math, what do you do?

37. Sometimes students have difficulty solving story problems. Briefly describe how you help your students solve story problems.

38. As of today, I have _____ students that are chronically absent.

39. When students who have been absent return to class, what do you do to catch them up?

40. List the kinds of manipulatives or educational equipment you use.

41. How frequently and for what purposes do you use them?

42. How do your students use calculators and computers?

43. How many years (including this year) have you taught math to 6 - 8 grade students? _____ years

44. How many years (including this year) have you taught? _____ years

45. How many years of college credit in math have you completed (including math methods courses)? _____sem. hrs. _____term hrs.

Science Teaching Style Inventory

PART I CLASSROOM PROCEDURES

Check the point within each of the following scales which most accurately describes your science class. (If you are teaching science for the first time or your present situation is very different from previous years, please respond as you anticipate your class will be like this year.) Respond according to what actually happens, not what you think should happen, or what you would like to have happen. There are no right or wrong answers. Answer all the questions.

1. Almost all help is initiated by students asking for it. _____1
_____2
_____3
_____4
Almost all help is initiated by my seeing the need for it. _____5

2. When students have trouble, I ask them leading questions. _____1
_____2
_____3
_____4
When students have trouble, I explain how to do it. _____5

3. Almost always many different activities are going on simultaneously during my class. _____1
_____2
_____3
Almost all the time the students are all engaged in the same activity during my class. _____4
_____5

4. In class, students frequently work together on assignments. _____1
_____2
_____3
_____4
Students seldom work together on assignments in class. _____5

5. Hands-on lab work is a regular part of my science class. _____1
_____2
_____3
_____4
Hands-on lab work is rarely part of my science class. _____5

6. Students frequently work in small groups in my science class. _____1
_____2
_____3
_____4
Students rarely work in small groups in my science class. _____5

7. I usually present science concepts first, then give examples. _____1
_____2
_____3
I usually start with several examples of a concept, then present the science concept to the students. _____4
_____5

8. Certain topics are repeated (but in more depth) on a regular basis throughout the year. _____1
_____2
_____3
Once a topic is covered that same topic is not covered again except during reviews. _____4
_____5

9. When I teach a new topic, I spend a good deal of time (1/3) trying to teach students to see similarities and differences between new and previously learned science ideas. _____1
_____2
_____3
New topics are generally taught with limited reference to previously learned science ideas. _____4
_____5

10. The furniture arrangement is the same for every science lesson. _____1
_____2
_____3
_____4
The furniture arrangement varies according to the lesson. _____5

11. In my science classes, a majority of the time is spent in helping students learn scientific vocabulary. _____1
_____2
_____3
In my science classes, a majority of time is spent on understanding and applying science principles. _____4
_____5

12. I seldom change my approach throughout the semester (such as lecture-discussion, discovery, etc.) _____1
_____2
I change my approach frequently (from discovery to direct telling or from another method to something different) throughout the semester. _____3
_____4
_____5

13. In my science classes, I stress logical reasoning. _____1
_____2
_____3
In my science classes, I stress understanding of terminology. _____4
_____5

14. Most questions I ask in class can be answered by students with yes, no, or with a few words. _____1 _____2 _____3

Most questions I ask in class require students to give explanation. _____4 _____5

15. In my class, I give different assignments to students with different ability levels. _____1 _____2 _____3

In my class, I give the same assignments to all students. _____4 _____5

16. When I plan for my science classes, I closely follow the content organization in the science textbook. _____1 _____2 _____3

When I plan for my science classes, I select and organize content without regard for the textbook. _____4 _____5

17. Students frequently use their science textbook during my science classes. _____1 _____2 _____3

Students rarely use their science textbook during my science classes. _____4 _____5

18. Students homework assignments are usually drawn from the science textbook. _____1 _____2 _____3

Students' homework assignments are rarely drawn from the science textbook. _____4 _____5

19. During my science classes, I refer to the science textbook frequently. _____1 _____2 _____3

During my science classes, I rarely refer to the science textbook. _____4 _____5

20. I usually start a new science topic with an overview that tells students what it is about and how it relates to other topics. _____1 _____2 _____3

When I start a new science unit, I plunge in and let students discover its relationship to other topics. _____4 _____5

PART II: CLASSROOM STRATEGIES

How frequently do you use the strategy in your classses?	About every day	Once/week or more	A few times/month	Once/month or less	Don't use
21. Whole class instruction					
22. Whole class discussion					
23. Small group work other than lab work.					
24. Laboratory work.					
25. Films, film strips, video tapes.					
26. Individual seatwork during which I move around the room and help individual students.					
27. Individual seatwork during which I do routine paperwork.					
28. Posing open ended questions					
29. Gathering and organizing students' responses.					
30. Teacher demonstrations.					
31. Analysis of data from labs or demonstrations.					

PART II: CLASSROOM STRATEGIES

How frequently do you use the strategy in your classses?

	About every day	Once/week or more	A few times/month	Once/month or less	Don't use
32. Analysis of information from newspapers, magazines, etc.					
33. Assigning homework.					
34. Discussing homework.					
35. Giving written feedback on homework.					
36. Simulations and games.					
37. Computer-based drill and practice.					
38. Computer-based labs and simulations.					
39. Student reports.					
40. Student demonstrations.					
41. Assigning projects to students.					
42. Assigning student reading in science magazines or books.					
43. Referring to reference books for information.					

PART II: CLASSROOM STRATEGIES

How frequently do you use the strategy in your classses?

	About every day	Once/week or more	A few times/month	Once/month or less	Don't use
44. Referring to the text for information.					
45. Students reading aloud from the textbook.					
46. Students reading silently from the textbook.					
47. Teacher-led question and answer session.					
48. Teacher presentations more than 10 minutes long.					
49. Quizzes.					
50. Tests.					

PART III TEACHER OPINION

Select the appropriate choice for each statement.

A = Agree
B = Somewhat agree
C = Undecided
D = Somewhat disagree
E = Disagree

51. _____ I am an effective science teacher.
52. _____ I like teaching science.

53. The job of a high school science teacher is a complex one. Several components of our work are listed below. Look over the following and

(1) place the letter **M** in front of **3-5 items** on the list which you think are the **most important** parts of your work.
(2) place the letter **L** in front of **3-5 items** which are the **least important** part of your work.

____ a. motivating students with a desire to learn science.
____ b. preparing students for high school science courses.
____ c. helping students learn about careers in science.
____ d. developing positive attitudes toward science in students.
____ e. helping all students learn basic principles of science.
____ f. identifying students who can become scientists and engineers.
____ g. conveying scientific information to students directly.
____ h. helping students learn how to apply science in their daily lives.
____ i. helping student develop a knowledge of scientific vocabulary and terminology.
____ j. helping students develop analytical thinking skills.
____ k. fostering creative thinking in students.
____ l. developing inquiry skills in students.
____ m. helping students understand and use the processes of science.
____ n. maintaining discipline and control in science classes.
____ o. making science interesting to students.

54. Does the list above omit any components of your work that you feel are very important? If so, describe these here or on the back of this page:

PART IV COMPLETION

55. As of today, I have ____ students that are discipline problems.

56. I assign science work to be done at home about ____ time(s) a week.

57. Think of your average students. When you make a homework assignment, approximately what percentage of the time is it?

    ____ completed in class by most students.

    ____ begun in class but finished at home.

    ____ done entirely (100%) at home.

58. When some students do poorly on tests or indicate that they have not understood a topic in science, what do you do?

59. As of today, I have _____ students that are chronically absent.

60. When students who have been absent return to class, what do you do to catch them up?

61. How many years (including this year) have you taught science to 7th grade students? _____ years

62. How many years (including this year) have you taught _____ years

63. How many years of college credit in science have you completed (including science methods courses)?

    _____ semester hours _____ (quarter) term hours

64. Is there anything you wish you knew more about or wish you could do better in order to teach science to junior high school students?

Appendix B-2

Results of the Teaching Style Inventory

Part I: Classroom Procedures

Teaching Style Inventory: Mathematics Support Teachers

(Ideal = 0-16)

Teacher	March 88	June 88	September 88	June 89	Change (3/88 to 6/89)
WB	30	26	15	13	-17
SD	26	21	20	17	-8
VM	38	37	19	21	-17

Part I: Classroom Procedures

Teaching Style Inventory: Science Support Teachers

(Ideal = 0-15)

Teacher	March 88	June 88	September 88	June 89	Change (3/88 to 6/89)
LR	30	24	19	15	-15
PM	35	35	19	11	-14
VD	38		23	13	-25
LB	29	21	22	16	-13

Results of the Teaching Style Inventory

Part II: Classroom Strategies

Teaching Style Inventory: Mathematics Teachers
(Ideal = 0-12)

Teacher	March 88	June 88	September 88	June 89	Change (3/88 to 6/89)
WB	17	16	16	12	-5
SD	17	15	15	14	-3
VM	20	22	18	17	-3

Part II: Classroom Strategies

Teaching Style Inventory: Science Teachers
(Ideal = 0-28)

Teacher	March 88	June 88	September 88	June 89	Change (3/88 to 6/89)
LR	43	39	33	35	-8
PM	54	54	40	43	-11
VD	56		46	42	-14
LB	60	54	49	46	-14

MSU/Toledo Public Schools
Mathematics & Science Support Teacher Project

Appendix C

C-1 Selected Science and Mathematics Support Teacher Interviews

C-2 Analysis of Individual Support Teacher Interviews

Interview 1: March 1988
Interview 2: September 1988
Interview 3: June 1989
Interview 4: May 1990

1. What are the big ideas in 7/8 grade mathematics/science?

WILMA BURNS-Mathematics Support Teacher

1 It is the last time they will have to learn mathematics. It is covering the basics--add, subtract, multiply, divide and problem solving. That is why I let them use calculators.

2 Numeration. I need to go back to what was on the blackboard [from the summer workshop] Geometry, Factoring, Estimating, Rational Numbers. My thinking has changed. It's now organizing my thoughts to the big ideas. I am not so fragmented in my thinking about where this content is going to fit into the big picture. I can justify not teaching something in one place and covering it in another. So I don't have to spend so much time going page by page.

3 Factors, multiples, ratio, measurement, similarity, patterns, numeration, problem-solving.

4 Number theory, rational numbers, decimals, percents and linking them together. Probability and statistics, problem solving that is integrated into the curriculum, and geometry. My changes in thinking over the years has been in establishing linkages and requiring less memorization.

2. (a) How do you know when a class period is/is not going well?

VANCE MARTIN-Mathematics Support Teacher

1 (a) When there are a lot of distractions in the class--when people are not focusing on the lesson. They are not attending to what is going on. It may mean they don't understand or they are bored. (b) The class today didn't go too badly, but I won't know until I do more extension. That's hard to say. I don't really think along those lines. Last week the thing I did with this class was mixed numbers and it was a learning situation. We divided up into groups of 4 and each person was responsible for doing one part of a *division of mixed numbers* problem. We set it up as a competition. I was pleased because I thought they understood the concept of the problem better. It went well but it had its downside.

2 The fact that I have the attention of the students.They are not falling off to sleep, or they are not talking to their neighbors, or writing notes. If I have their attention because of something we are doing either myself or they themselves are doing--that their focus is on math work. I think their responses, too, show me that they are more into it. When they are, they are more apt to respond to questions, they are more cooperative, less likely to be distracted from doing something else. So far, I have been able to have that success. My approach this year is different, I am trying to get them more involved. [*Mike talked about a lesson he taught on integers where he had students play a card game. This is a good segment which shows the change from his previous computational or algorithmic orientation.*]

3 The class is going well when I feel students have been actively involved in it. They have enjoyed it and they have had fun. They have had an understanding of the lesson, an appreciation for what they have done. I can feel that they are on task and being involved in the math lesson. When they are pursuing the idea of the lesson--that they are not just doing something to get it over with. That has manifested itself in how active, cooperative and productive they are. When the class is not going well there is more off-task time, more note writing, more playing around. It is that at the end of the period they seem glad the class is over rather than being actively involved.

4 When the kids have too many questions, then I don't think they really understand what their task is supposed to be. If they do keep asking questions when they understand the task, then they are asking questions of the nature that they want you to do the work for them. You've got to turn that into a situation where they can do the work. You can do that by either not helping them or by asking them their own questions back. I have a lot of kids who will do that because if they ask enough questions you will almost do the work for them. I am trying to get away from that and I am trying to make the

kids work on their own. This upsets them. They think you're not trying to help them--when you really are helping them become independent thinkers. I want them to be actively involved and I want them to have more input into the class because they are interacting with each other for instructional purposes, not socialization. When the class is going well the kids help each other, ask each other questions. When they are off-task it may be the fault of the students or the lesson.

4. (a) What motivates your students to learn the content?
(b) What motivates your students to complete their assignments?

SUSAN DAY-Mathematics Support Teacher

1 (a) In most cases it is grades. It is because some feel it is crucial to them in high school. In some cases it is parent motivation. (b) Grades. Those that complete the assignments are those that don't want a 0.

2 (a) Unfortunately, (I say that now--I probably didn't say that before) I think it is grades. It really shouldn't be, but think it should be a part of it. There isn't as much of them just realizing it is important to learn something. I would want to see something else motivating them. (b) Grades--unfortunately.

3 There is still the element of grades--even in algebra. In my regular classes I have seen a little bit of a change in that I felt there has been more interest in what we have been doing so that the motivation has come a little more from the fact that what we were doing was more interesting. That's what I want to try to build more on.

4 There are some grades involved--but I have heard less this year as far as the grade aspect. There is parental pressure. This year I see more of them trying to learn it because they see some use to it. I try to make it fun. Student enjoyment and participation are motivating to them. Working in groups is motivating to them. They get motivated when they work on problems that have a theme or a continuation of a theme. The Algebra With Pizazz is motivating to them.

6. How important is practice in your classes?

VANCE MARTIN-Mathematics Support Teacher

1 That is essential. I think kids at this stage need the reinforcement and practice. I think the practice should tie together with evaluation. The drill they do in class should be continuous enough to tie together the tests and material they practice on. I do give homework because I do feel they need that constant drill.

2 I think practice is important because it does reinforce the concepts you are trying to get across to the kids. I don't want to have practice to the extent that it becomes tedious and boring. I thought the students were doing practice when they were playing their card games. It is important, but it can be done in a different way.

3 Not as important as the skill and drill was in the past. As far as the content of the curriculum this year--I have not spent time of skill and drill. There is still a place for practice, but I don't think it is at the same extent as it was in the past.

4 Drill and skill is not important--practice is important. I give them more problem solving activities and have them work together. That is a different approach from what I did before. Practice is a stabilizing concept. Practice is needed to keep in mind the relevant concepts. Not practice for practice sake it is important, but it is not essential.

7. One frequently hears the statement, "It is important that students understand the content." (a) What does that mean to you? (b) How do you know when students do not understand the content?

SUSAN DAY-Mathematics Support Teacher

1 (a) It means more than the ability to do an operation. It should mean seeing a lot more about a particular problem. It's more than what's in the book. (b) By their responses--the students will verbalize to me that they don't understand. Sometimes I give them a couple of problems and I can get around the class to see if they have problems.

2 (a) Understanding the content to me has changed. Because not it is becoming more crucial that they not just are able to give me an answer, but that they actually understand what they've done. To me, now, that means understanding the content. Asking students, "What did you do?" and "Explain it to me." (b) By asking them to explain it to me. When they can give me another example or they can verbalize to me what they have done. An A on a test doesn't tell me they really understand it.

3 (a) The student has an understanding of the concept it doesn't mean that he/she just memorizes a rule. It is important that they understand what they are attempting to do and not just applying a formula. (b) If they can apply an idea in a problem solving situation--if they can represent the idea by drawing it and writing about it is further evidence that they understand. Writing in mathematics came from a reading in the School Science and Mathematics Journal I read in March. Drawing whatever they might be working on is a way for them to see what they understand. Using some of their problem solving strategies helps them understand. Next year I have been taking a look at ways to evaluate

4 It has come to mean that the students can use and apply what they have learned to various situations. That they have various ways to see and solve problems. It means that they don't just have one way to see things. Understanding is not just remembering memorized rules. The students need to know why they are doing what they are doing.

7. One frequently hears the statement, "It is important that students understand the content." (a) What does that mean to you? (b) How do you know when students do not understand the content?

LARRY BROWN-Science Support Teacher

1 (a) If you are teaching from the book the students should know what we cover in class. You have a hard time teaching concepts without the content. (b) Class discussions, tests, quizzes. Mainly it is class discussions.

2 (a) That has changed. Content was always terminology and I am finding another way of approaching concepts. Content now means understanding the concepts. Mind stretchers have helped. (b) Testing didn't always tell you what they did or did not know. If you can sit down with the kid and have him tell you what he was thinking--then you know.

3 Content used to be the terminology--Now it is trying to get an understanding of the ideas and learning them. It is not just a bunch of words. I have changed my use of the textbook. There is just too much there in the textbook.

4 That they know the content--traditionally, it has been memorizing the terms. There is a lot less content--it is still there, but there is no way it can all be covered. They understand it when they've thought through what we've been discussing and they really understand the big ideas. "Why?" is the big question.

9. What characteristics do you like to see in your students, and classes?

WILMA BURNS-Mathematics Support Teacher

1 Students and classes that try and that work together.

2 I like to see them come in and sit down and be ready to get busy with what we are going to do.

3 Questioning, kids that accept and work well with other kids. Willingness to try. Not afraid to talk or to try.

4 Kids actively involved in what's going on. Kids talking with one another. Students taking on a helping attitude in math. Kids helping one another. To have fun in math. That they are there to help everybody.

10. How would you describe the role of teacher as enacted by you?

LARRY BROWN-Science Support Teacher

1 I am a facilitator, someone who helps them out. Disseminates knowledge--an expert in an area. They have to follow some rules--so you are there to direct them--head them in the right direction.

2 I am a person who has knowledge about the content and one that gets students into group work. A little less of a provider of information and a little more of a person who is trying to pull information from the students. It is more fun this way. It is more rewarding.

3 The role is definitely not that of a lecturer, not a note-giver and it is not someone who has all the knowledge. My role is to come up with good problems or situations, to challenge them to learn and think. It is a difficult role - - I know that for sure.

4 I am less of a knowledge imparter and more of a knowledge giver. I am someone who helps kids think through problems and to solve them. I am not just a lecturer.

11. What is your interpretation of the support teacher role?

PATRICK MITCHELL-Science Support Teacher

1 Nobody knows. I need some direction about what's going on. I don't know what's happening. I have to make a classroom observation of what's going on in the classroom--it is very vague. Half the people at our meeting couldn't figure out the readings. Are we supposed to come up with better teaching methods? Is that what we are supposed to be doing? Are we trying to find out what works?

2 Being able to come up with better teaching methods, help other people who want help in finding better ways of teaching and learning more by observing teaching. I am becoming much keener in what I am looking for when I observe. I am a resource person. I am careful in what I say and do with the teachers.

3 A lot of things. The first is to get the faculty more involved as a unit--to exchange ideas. The second, as a resource person for new people. To set up resource labs and to set up meetings where we can exchange ideas. To get them involved as much as I can. To try to get teachers to understand I am not a dictator, that we are here to improve our teaching and most of all to improve our kids results. I start the year with short 15 minute meetings and the time eventually increases over the year. We go anywhere from 20 minutes to an hour. By the end of the year the teachers carried the ball for the meetings.

4 Many factors. I am a counselor, a whipping board, a resource person, an experimenter, working with people, a public relations person, and an observer. I help teachers improve their teaching. I'm a facilitator at meetings. I have to be flexible and fluid. There are many facets to the job. There is the liaison between me and the administration. A liaison between me and the teachers. Stroking teachers and saying something positive. I have to practice what I am preaching and I have to work at changing my teaching. I see myself as a researcher. I am a doctor, constantly practicing and changing my ways of teaching and trying to convince others to see the value of group work. My role changes based on the problems you run into. A military guideline won't work, it's got to be fluid.

11. What is your interpretation of the support teacher role?

VICTORIA DENNIS-Science Support Teacher

1 It is vague. It is getting me to look at myself a whole lot more than I have in the past. I guess that's good. In doing so I am assuming I will be able to help other teachers in what they are trying to do. Putting us through this from you will make it easier to have me and what I do more accepted by my teachers.

2 To be a helper in any way that I can with the teachers in my department, whether it be helping with a lesson, helping with a particular class, sharing ideas. I felt really good yesterday--I have one teacher who is really anxious about the program, and he finally realized that what we had been doing all along, over the years, is the same as what we would be doing now. He was afraid he would have to do something along the way that he didn't want to do. Hopefully, I reassured him. Already I saw him use the mind stretcher. Now, he is making plans to inventory all of his audio-visual materials to share with all the other teachers.

3 My goal is to have my department more interested in student learning, conceptual learning and the part I can play to aid in it. I will continue to do the observations. I hope they will begin to come to me. They have to go through the same process I did. It involves change and they have to make that decision.

4 I am here as someone who can help them - - I like that other pair of eyes in the classroom idea. I am here to bounce ideas off one another. I try to remove the isolation that the teachers feel. I like the term "Support" and I try to do it in any way I can - - with materials, emotional and moral. I thought change would happen quicker. I do get concerned about how long it took me to get to this point and I am with it all the way and I have had you [MSU team and the other Support Teachers] with me all this time. How is anyone else going to be trained to be a good Support Teacher without that support? A Support Teacher is someone to share ideas. It is depressing that change is so slow. I am viewed as administration by the other teachers. I went through a period when I was really down on myself.

12. What would improve the learning opportunities for students in your classes?

SUSAN DAY-Mathematics Support Teacher

1 I would like to have available a tutor for some of the students.

2 It is having more input into what is going on in the class. More ways for them to get actively involved. I said this to one of the math teachers. I said, "We [teachers] have a tendency to bore them to death." If you give them these well structured activities (MGMP) that have a real purpose to them, then they are not just listening to you.

3 The more activities that I can come up with that make math less drudgery for them. Better group activities so they can explore some of these things on their own. I am accepting more responsibility for what's happening--I really do feel that way.

4 More interaction--more time to discuss among themselves. Encouragement to not feel threatened in class. To get them to open up. The atmosphere/environment has to be such that you're promoting learning.

12. What would improve the learning opportunities for students in your classes?

LARRY BROWN-Science Support Teacher

1 Smaller classes. Put kids who have problems with reading in classes where they can get help.

2 Class size--you can do so much more with smaller classes. Materials are also important.

3 It is important to integrate the honors kids into regular classes. I wouldn't have said that last year, but as a result of all the reading and discussion I have done I would say that that's what we have to do.

4 If the teachers would use group work and cooperative learning more. If they would spend time attacking the concepts. If they would relax and realize that they aren't going to cover it all. I think they should accept the idea that the Support Teacher Program is an experiment and it won't solve all their problems. I need to go back to my classes and see what has improved in them

13. What improvements would you suggest on a school-wide basis?

VICTORIA DENNIS-Science Support Teacher

1 In our school there is the policy that students have the right to fail. I'm not comfortable with that. Some teachers say they just give up on kids. We never get together, it would be helpful to meet together. There is no time to meet with students after school.

2 Common planning time to meet with the teachers. My next hurdle will be to find something worthwhile to share with them and to find the time to meet with them. We have a school-wide curriculum guide and I would like to see all the grades doing what they are supposed to be doing. So that I will know all 8th graders would have had all that was in the guide.

3 In the department, we are having teachers look at what they are doing. My teachers are sharing what they are doing with each other. There is more interaction and communication now. There are more meetings too. The 7th grade teachers meet during school as a group and the 8th grade teachers meet before and after school.

4 I would like to see more sharing among the teachers. More interdepartmental activities going on. More collaboration.

14. How do you assess the Support Teacher Program activities so far?

VANCE MARTIN-Mathematics Support Teacher

1 There is still not a clear perspective on the role of the support teacher. Observations are a problem--do we observe teaching style or curriculum? I don't want to be part of a program that is critical of the way teachers teach.

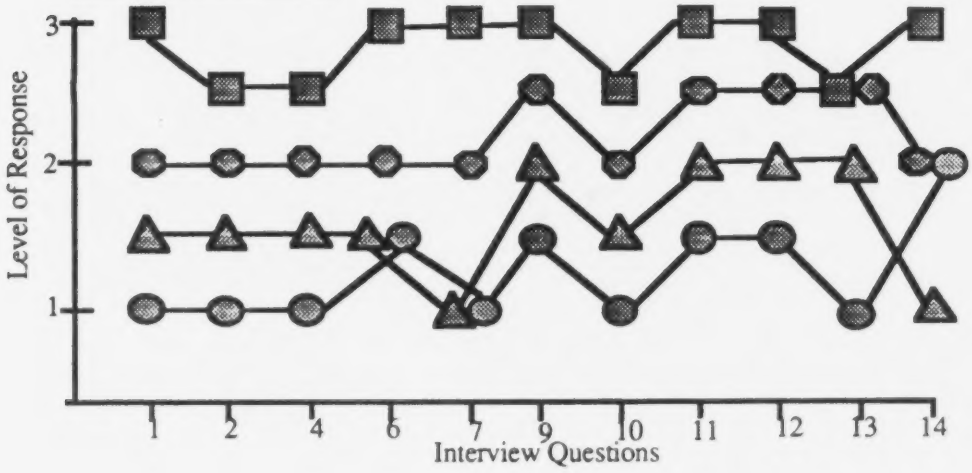
2 The program has opened up a whole new world for me. It has made me refocus my direction and my thinking and at the same time it has given me a lot of enthusiasm and spirit. It is still a little too soon in the year to see how it is going. Most people [other support teachers] are at a point where they can say they can potentially see some benefits. But, they are not at the point where they can actually feel secure in saying that. As the year goes on I would like to see more evidence of the benefits.

3 This whole year has been a learning experience for me. There has been a lot of frustrations and rewards as well. I have seen a lot more interest in math learning and how teachers can provide opportunities to help students learn better. There has been resistance. I am looking forward to next year. If next week were September I'd have a whole different perspective of what I'd do as a support teacher.

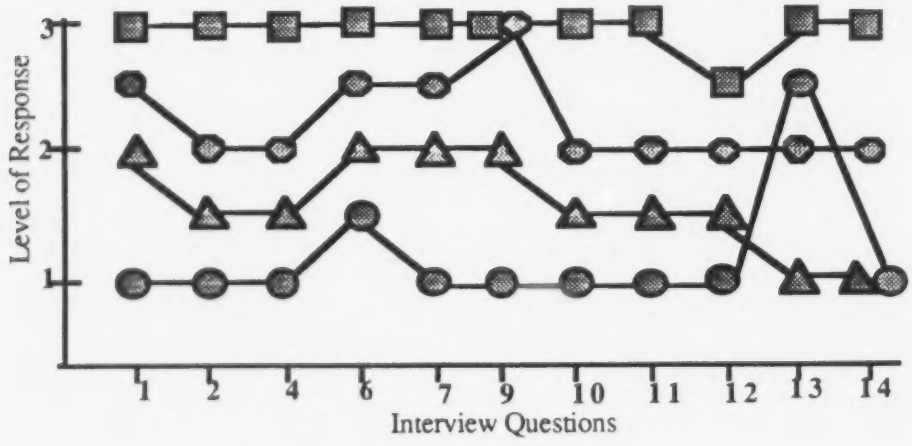
4 I get a sense that the teachers are thinking about next year. Because of the interaction and collaboration, teachers are a lot more aware of their own teaching and their students' learning. They are questioning their practice. I would like to see each teacher have 2 planning periods-one for private planning and one for group collective planning. I am getting the teachers to ask themselves what did the students learn --and to be able to know if changes need to occur. Sometimes I suggest ideas and we try them together. I think it is a very valuable program in the school and there will be a big pay-off for students and teachers.

C-2: Levels of Responses of the Individual Interviews

Teacher: Wilma Brown



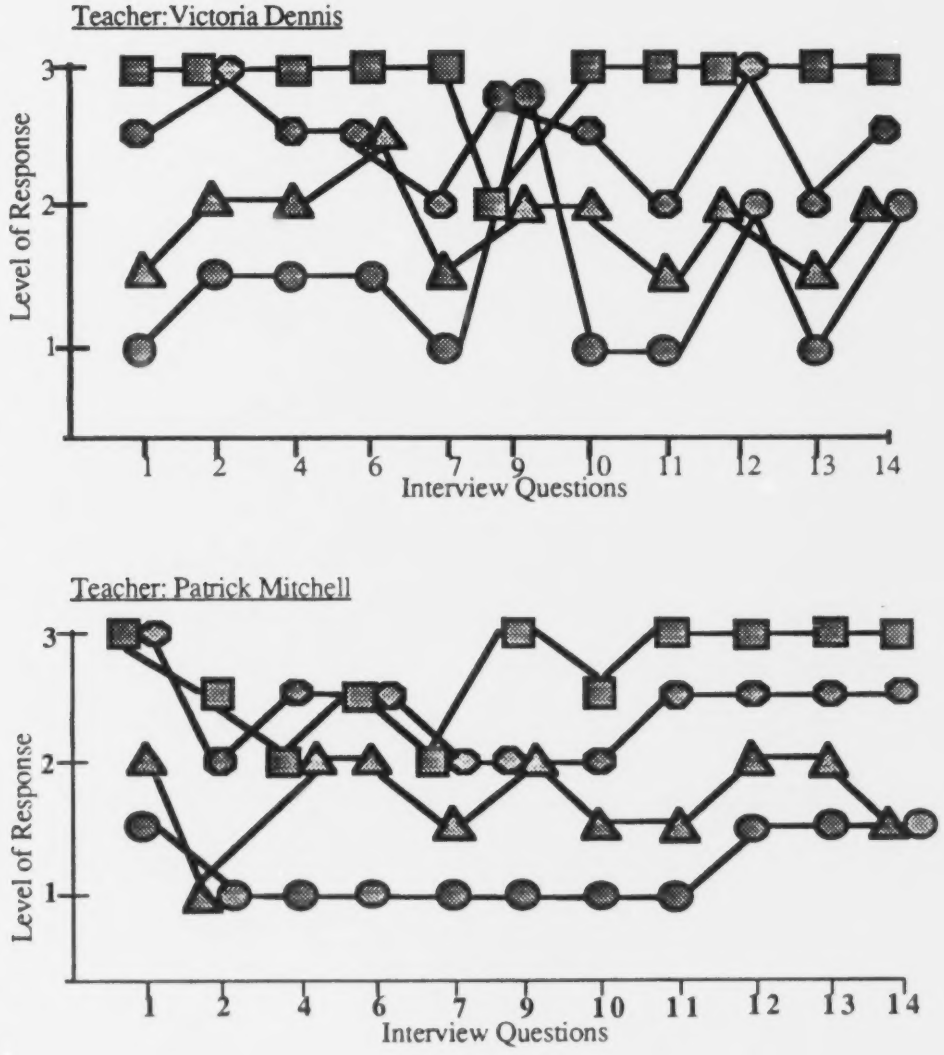
Teacher: Vance Martin



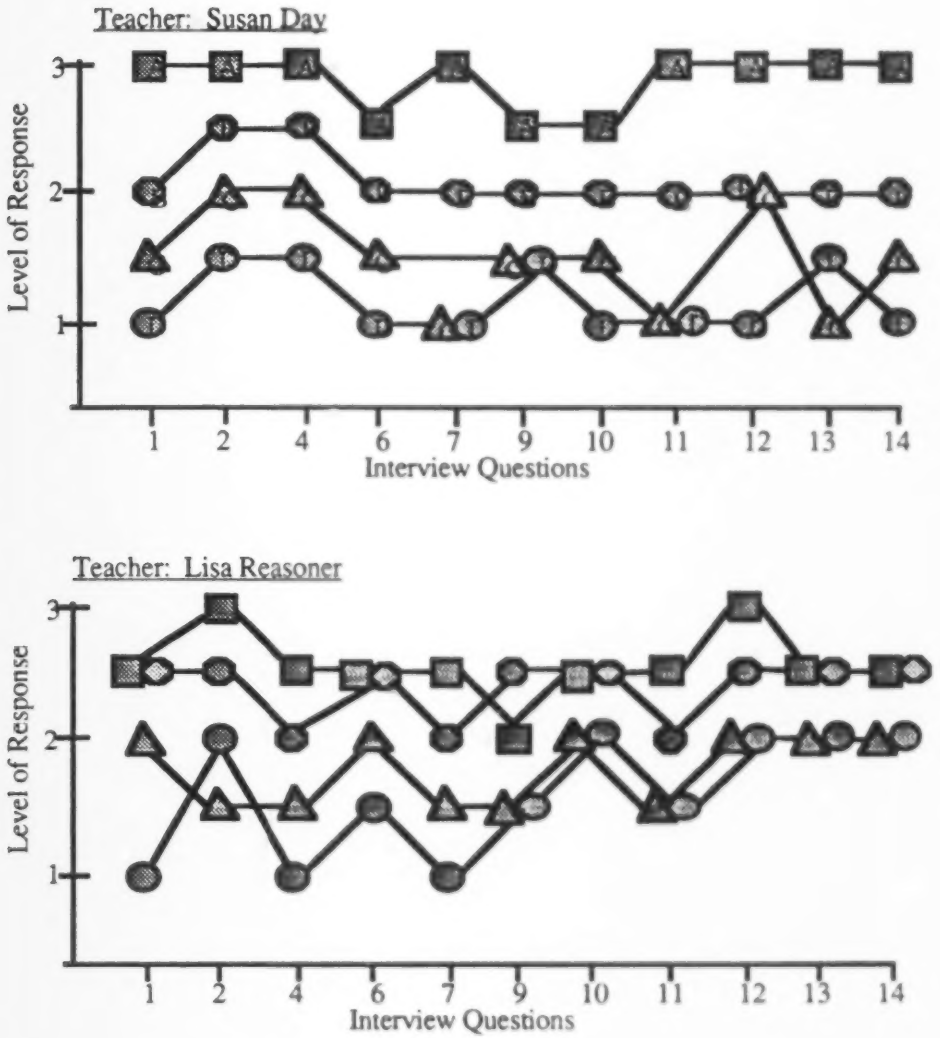
INTERVIEW DATES
- March 1988
- September 1988
- June 1989
- May 1990

LEVELS OF RESPONSE
1 = Conceptual/Nontraditional
2 = Transitional: Procedural/Conceptual; Traditional/Nontraditional
3 = Procedural/Traditional

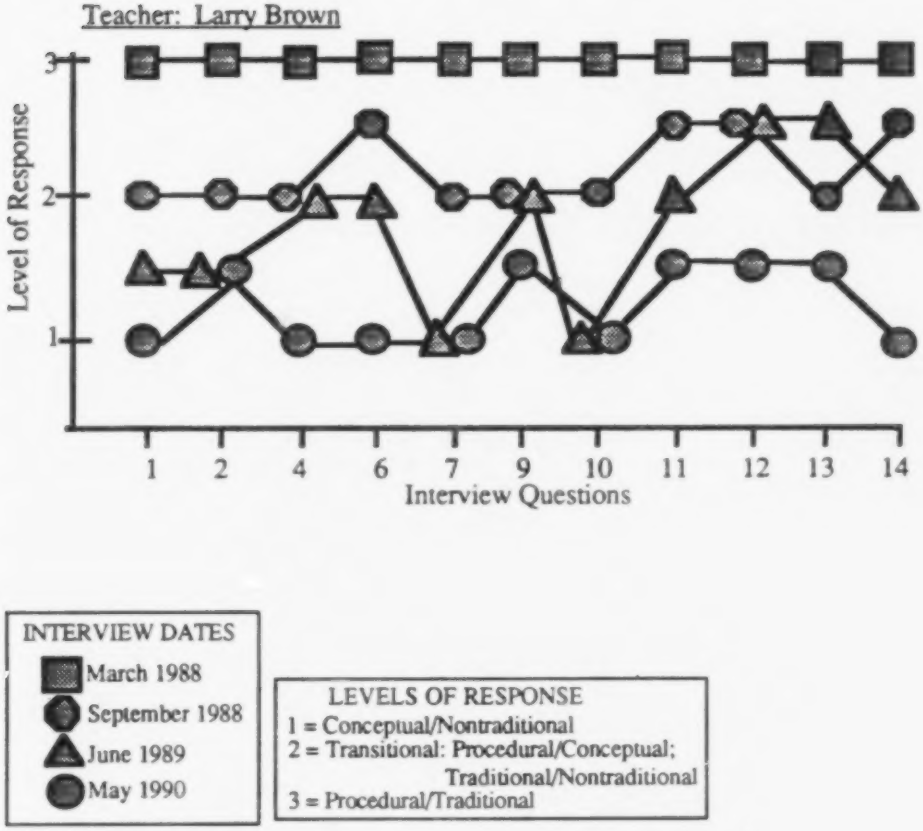
C-2: Levels of Responses of the Individual Interviews



C-2: Levels of Responses of the Individual Interviews



C-2: Levels of Responses of the Individual Interviews



MSU/Toledo Public Schools
Mathematics & Science Support Teacher Project

Appendix D

Changes in the Science and Mathematics Support Teacher Curriculum

Appendix D
Mathematics and Science Support Teachers' Curriculum from 1986-87 and 1990-1991

WILMA BURNS-Mathematics

1986-1987

TOPIC	WEEKS
Whole Numbers & Operations	4
Number Theory	1 1/2
Fractions	5
Decimals	3
Equations	3
Geometry	4
Ratios	1 1/2
Percents	4
Perimeter, Area, Volume	4
Integers	3
Real Numbers, Coordinate Plane	3

Reflection of Past Curriculum:
"I went straight through the book." (WB)

1990-1991

TOPIC	WEEKS
Probability Unit (MGMP*)	6
Integers	3
Fractions	7
Measurement Using Fractions	2
Mouse & Elephant Unit (MGMP*) & Textbook Area & Volume	7
Equivalency (Decimals, Proportion, Percent)	5
Informal Equations	2
Measurement (Metric)	2
Spatial Visualization Unit (MGMP*)	2
Problem Solving	daily

*Middle Grades Mathematics Project Unit, Addison-Wesley Publications

VANCE MARTIN-Mathematics

1986-1987

TOPIC	WEEKS
Whole Numbers & Operations	3 1/2
Integers	3
Exponents & Powers of Ten	4
Decimals	3 1/2
Percents	4
Fractions	6
Equations	3
Coordinate Graphing	4
Geometry	4
Metric Measures	3

1990-1991

TOPIC	WEEKS
Integers	2
Mouse & Elephant Unit (MGMP*)	7
Factors & Multiples Unit (MGMP*)	7
Fractions, Decimals, Percents	5
Equations & Graphing	4
Probability & Statistics	4
Problem Solving Strategies	9

*Middle Grades Mathematics Project Unit, Addison-Wesley Publications

SUSAN DAY and Teacher Colleagues-Mathematics

7th Grade 1986-1987

TOPIC	WEEKS
Problem Solving Strategies	1
Whole Numbers	4
Decimals	3
Patio, Proportion, Percent	4
Number Theory	2
Fractions	4
Measurement	2
Geometry (Angles, Polygons)	3
Perimeter, Area, Volume	4
Integers	1

Reflection of Past Curriculum:
"What in the world did we spend our time doing in the past?" (SD)

7th Grade 1990-1991

TOPIC	WEEKS
Problem Solving Strategies	4
Decimals	4
Factors & Multiples Unit (MGMP*)	4
Fractions	7
Ratio, Proportion, Percent	5
Similarity Unit (MGMP*)	4
Geometry (Angles, Polygons)	3
Spatial Visualization Unit (MGMP*) Part I	1
Integers	2

*Middle Grades Mathematics Project Unit, Addison-Wesley Publications

SUSAN DAY and Teacher Colleagues-Mathematics

8th Grade 1986-1987

TOPIC	WEEKS
Whole Numbers	3
Decimals	3
Number Theory	2
Fractions	4
Equation Solving	3
Geometry	3
Ratio, Proportion, Percent	3
Measurement	1
Perimeter, Area Volume	3
Integers	2
Rational Numbers	2
Graphing	2
Geometry (Trigonometry, Pythagorean Theorem, Right Triangles, Similarity)	2

8th Grade 1990-1991

TOPIC	WEEKS
Review	2
Problem Solving Strategies	4
Mouse & Elephant Unit (MGMP*)	4
Probability Unit (MGMP*)	4
Statistics	4
Spatial Visualization Unit (MGMP*) Part II	1
Geometry (Trigonometry, Pythagorean Theorem, Right Triangles, Similarity)	3
Algebra (Integers, Equation Solving, Graphing, Misc.)	10

*Middle Grades Mathematics Project Unit, Addison-Wesley Publications

VICTORIA DENNIS-Science

1986-1987

TOPIC	WEEKS
Introduction to Science (and Metrics)	6
Weather	8
Astronomy	7
Fresh Water & Oceans	3
Rocks & Minerals	2
Earthquakes, Volcanoes Plate Tectonics	3
Weathering & Erosion	4
Glaciers	3

1990-1991

TOPIC	WEEKS
Introduction to Science (and Metrics)	7
Weather	12
Astronomy	8
Fresh Water & Oceans	4
Rocks & Minerals	3
Earthquakes, Volcanoes Plate Tectonics	4

PATRICK MITCHELL-Science

1986-1987

TOPIC	WEEKS
Foundations of Earth Science	~6
Astronomy	~6
Geology	~6
Earth's Atmosphere	~6
Earth's Waters	~6
Earth's History	~6

1990-1991

TOPIC	WEEKS
Foundations of Earth Science	~9
Astronomy	~9
Geology	~9
Earth's Atmosphere	~9

LISA REASONER-Science

1986-1987

TOPIC	WEEKS
Introduction to Earth Science	
Matter, Molecules, Energy	8-9
Geology	
Earth's History: Interior and Surface (Rocks, Minerals, Weathering, Erosion, Volcanoes, Plate Tectonics, Etc.)	18
Astronomy	
The Earth in Space (Universe, Galaxy, Solar System)	9-10

Reflection of Past Curriculum:
"I went right through the book and tried to cover as many chapters as I could." (LR)

1990-1991

TOPIC	WEEKS
Introduction to Earth Science: What Things are Made Of	
Matter, Molecules, Energy, MSU Unit on Matter & Molecules	11
Atmosphere & Weather	10
Hydrology	
Fresh Water & Oceans	
Meteorology	6
Geology: Earth's Interior	
Earth's History: Interior and Surface (Rocks, Minerals, Weathering, Erosion, Volcanoes, Plate Tectonics, Etc.)	10

LARRY BROWN-Science

1986-1987

TOPIC	WEEKS
Scientific Method & The Characteristics of Living Things	3
Metric Measurement	1
Basic Chemistry (Elements, Compounds)	2
Classification of Animals	6
Cell Theory	3-4
Plants	3-4
The Human Body: Systems	8

Reflection of Past Curriculum:
"I used the text for most of the chapters I taught." (LB)

1990-1991

TOPIC	WEEKS
Observation & Inference (Strand Used in Every Unit)	everyday
Building Blocks of Living Things (Cellular Respiration, Cellular Reproduction, Cell Theory, Cell Structure, Activities of Living Things)	10-12
Bacteria & Fungi	5
Animal Kingdom (Understanding of the Classifications)	3-4
Plants (Photosynthesis, Plant Structure, Connections to Cell Theory)	3-4
Ecology (Food Webs, Food Chains, Greenhouse Effect)	3-4

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